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BIDDLE'S

MATERIA MEDICA

AND

THERAPEUTICS.

MATERIA MEDICA

AND

THERAPEUTICS,

FOR PHYSICIANS AND STUDENTS.

BY

JOHN B. BIDDLE, M. D.,

LATE PROFESSOR OF MATERIA MEDICA AND GENERAL THERAPEUTICS IN THE JEFFERSON MEDICAL COLLEGE, PHILADELPHIA.

TWELFTH EDITION,

REVISED, REARRANGED AND ENLARGED,

WITH SPECIAL REFERENCE TO THERAPEUTICS, TOXICOLOGY, AND
TO THE PHYSIOLOGICAL ACTION OF MEDICINES.

BY

CLEMENT BIDDLE, M. D.,

MEDICAL CORPS U. S. NAVY.

WITH

NUMEROUS ILLUSTRATIONS, MANY OF WHICH ARE NEW TO THIS EDITION.

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PREFACE

TO THE TWELFTH EDITION.

In preparing this edition of the Materia Medica and Therapeutics the editor here desires to call attention to the many changes made in the work, which has received at his hands a careful and thorough revision, bringing it up, he believes, fully to date, and which he trusts will now be found to be a reliable text book upon the subjects of which it treats.

For the sake of reference and system the chapters on the consideration of each remedy, where practicable, have been arranged under the headings, DESCRIPTION, CHEMICAL CONSTITUENTS, INCOMPATIBLES, AIDS, CONTRAINDICATIONS, PHYSIOLOGICAL EFFECTS, TOXICOLOGY, ANTIDOTES, MEDICINAL USES, and ADMINISTRATION. This division, it is thought, will materially aid the student in his studies.

In detail the following additions and alterations have been made, viz.: New articles beginning at page 54, upon the classification ot Pharmacological Agents; then on Sulphonal; the Myotic Alkaloids; the Alum, Sulphur, Saline, Lithian, Calcareous, and Alkaline Natural Waters; Enemata; Exalgine; Aristol; Ichthyol; and lastly Dermatol. The consideration of Electrical Therapeutics and the chapters on Cocaine, Naphthaline, and Naphthol, will be found much amplified and largely rewritten. Iodoform and Iodol are transferred from Alteratives to Antiseptics as being more in conformity with their physiological effects.

Nineteen new cuts have been added to this edition as well as a complete index of DISEASES AND REMEDIES. Exclusive of the two indexes, the work has been increased by thirty-three pages; while the INDEX itself, which seemed altogether too full, has been materially cut down.

The editor here desires to thank most cordially Dr. T. D. Reed, of the Montreal College of Pharmacy, for various suggestions and corrections furnished by him for this edition. His thanks are also due to Prof. F. B. Power, who kindly pointed out some errata in the eleventh edition, and to Dr. Henry Morris, who contributed much material, particularly the chapter on Antiseptics and Antipyretics, to the same edition.

Anyone discovering errors in this work, and who will take the trouble, for the sake of future accuracy, to report the same to the Publishers or Editor, will be sincerely thanked for their pains.

The Editor takes great pleasure, as in former editions, in renewing his dedication of this work to the gentlemen in attendance upon the various medical schools of North America.

CLEMENT BIDDLE.

1902 Pine St., Philadelphia, October, 1892.

PREFACE

TO THE EIGHTH EDITION.

THE exhaustion of the seventh edition of the Materia Medica within little more than a year since it was issued, having rendered necessary the publication of a new edition, it has been carefully revised, much of it has been recast and even rewritten, and many new articles have been added. The author trusts that it will be found to have kept pace with the progress of pharmacological science, and to contain all important recent contributions to the various departments of pharmacology.

The illustrations of the book comprise, as in previous editions, representations of most of the important indigenous and naturalized plants, as well as diagrams of instruments employed in the atomization of liquids, in the new operation of pneumatic aspiration, in the transfusion of blood, and in the recently-introduced pneumatic method in the treatment of thoracic diseases.

The author has aimed in this, as in previous editions, to present a succinct account of the articles of the Materia Medica in general use in the United States, and discussed in the courses of lectures delivered upon the subject, to which he trusts the work will be found, as heretofore, to furnish a suitable text-book. He takes pleasure in renewing his dedication of it to the gentlemen in attendance upon the various medical schools in North America.

JOHN B. BIDDLE.

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MATERIA MEDICA AND THERAPEUTICS.

I. THE agents employed in the treatment of diseases are denominated REMEDIES, and the branch of medicine which is devoted to their consideration is termed MATERIA MEDICA. Remedies may be divided into HYGIENIC, MECHANICAL, IMPONDERABLE, and PHARMACOLOGICAL, agents.

II. By THERAPEUTICS is meant the application of remedies to the treatment of disease. It includes, in a broad sense, the use of remedial measures of all sorts, as climate, diet, baths, nursing, clothing, massage, electricity, and physical exercise. Therapeutics may be divided into *rational* and *empirical*.

By rational therapeutics is meant the administration of a remedy for therapeutical purposes based upon what is actually known of its physiological action. Thus it is given beforehand with a definite idea of what it is to accomplish and consequently when so taken antagonizes a particular pathological condition with some degree of certainty. The use of digitalis in the relief of mitral regurgitation is an example of rational therapeutics, since this drug is well known to prolong the diastole and energize the systole of the heart, thus more completely filling and emptying its cavities and consequently overcoming the obstruction to the regular flow of the blood: hence its exhibition is indicated on rational grounds.

Empirical therapeutics consists in the administration of remedies at haphazard because previous experience has demonstrated their efficiency in certain affections, while the explanation as to their action remains totally obscure. The exhibition of opium as an anodyne and hypnotic is an example of empirical therapy. That it deadens pain and induces sleep is well understood, but the way in which it does so is completely unknown. The majority of drugs are employed empirically.

HYGIENIC REMEDIES are usually treated of in works specially devoted to the subject.

PART I.

MECHANICAL REMEDIES.

Mechanical Remedies belong chiefly to Surgery. A few agents of this class being, however, employed in the practice of medicine, are included in the Materia Medica. They are Blood-letting (general and local), Setons, Issues, Bandages, Friction, Acupuncture, and Aspiration.

1. **General Blood-letting** is performed principally by *venesection* or *phlebotomy*, which is usually practiced on the median-cephalic or basilic veins of the arm—sometimes also on the external jugular and other veins. From the veins at the elbow it is done by passing a ligature above the point selected, the patient being in the sitting posture, and making an incision in the most prominent vein ample enough to permit f℥ij–iij of blood to escape per minute, and allowing it to flow until syncope approaches. To stop the flow, remove the ligature, apply a compress, and place the patient in the recumbent posture. *Arteriotomy* is occasionally resorted to, on the temporal artery, in cerebral affections.

Medicinal Uses.—Blood-letting is employed to moderate *vascular excitement*, reduce inflammatory action, alter the quality of the blood (diminishing the proportion of fibrin, albumen and salts), relieve congestion, allay *spasm* and *pain*, relax the muscular system, promote absorption, arrest *hemorrhage*, remove stasis, and prevent cell proliferation and *inflammatory effusions*, and for these purposes it has long been considered a valuable therapeutical resource. So powerful and exhausting an agent is, however, always to be resorted to with caution and discrimination; is not to be unduly repeated, even in inflammatory cases; and is seldom or never proper in disease of a typhoid tendency, or where a tubercular diathesis is suspected, or in extreme infancy and old age. It is indicated in inflammations and conditions of sthenic type occurring in robust adults, and accompanied by a full, bounding, tense pulse, and should only be resorted to early in the case, before inflammatory effusions have taken place. Under these circumstances it may be of service to abort *apoplexy* and to relieve *puerperal eclampsia*.

2. **The Local Abstraction of Blood** is practiced by means of *leeches*, *cups*, and *scarifications*. When a leech is applied between the inflamed area and the heart the blood-current is accelerated, stasis removed or prevented, as is also the migration of cells and the effusion of serum. Scarifications produce the same results in a less degree, and also give vent to effused fluids. The leech (*hirudo*) is an annulated aquatic worm, with a flattened body, tapering toward each end and terminating in circular flattened disks; which is found throughout Europe, America and India. The European leech (*h. medicinalis*, termed also *sanguisuga officinalis*) is of a blackish or grayish-green color on the back, from two to three or four inches in length, and is characterized by six longitudinal dorsal ferruginous stripes, the four lateral ones being interrupted or tessellated with black spots. It draws about f℥ss. The American leech (*h. decora*) is usually from two to three inches long, and is of a deep green color, with three longitudinal dorsal rows or square spots. Both the imported and indigenous leech are employed in this country, but the latter makes a smaller incision, and is preferable in infantile cases. It takes about fʒj. When the discharge of blood from leech-bites is excessive, it may be arrested by pressure, compresses of lint, the application of alum, creasote, solution of iron subsulphate, and other styptics, or by cauterizing the wound with silver nitrate or a red-hot probe; and if these means fail, the lips of the wound may be sutured.

When blood is drawn by leeches, its continuous flow may be promoted by the application of warm fomentations to the wounds.

In the operation of *cupping*, cupping-glasses and a scarificator are employed. The removal of atmospheric pressure, by the application of glasses partially exhausted of air, which may be done by igniting a little alcohol in each cup immediately before its application, produces a determination of blood to the capillaries of a part, which is afterward readily drawn by scarification. When blood is not abstracted, the operation is termed *dry cupping*, and is a valuable revulsive agent. The topical abstraction of blood by leeches and cut-cups combines the advantages of depletion and revulsion. Cups are generally preferable in internal inflammations, from their more decided revulsive influence. Both the dry and wet cups are employed in a wide range of affections in which the local abstraction of blood and a revulsive action may seem necessary to influence distant organs, as in the first stage of *acute Bright's* disease, as well as in the *chronic forms;* here the cups should be applied over the renal region. Wet-cups are also of service in *uremic convulsions* and *uremia. Leeches* are *employed* in the early stages of external inflammations where cups would obviously be inadmissible and in infantile cases. They are applicable to the treatment of forming *abscess*, *adenitis* and *bubo*, applied near or over the affected part or glands, to relieve *cerebral hyperemia*, *uremic convulsions*, *metritis* and *endometritis* (to cervix), *keratitis* (temple), *myelitis* (spine), and *myringitis* (mastoid). As leech-bites make scars, they should be cautiously applied over an exposed part, as the female face; nor should they be used where there is much loose connective tissue, as the scrotum and eyelid; over a superficial vessel or nerve; seldom over the seat of morbid action, nor in the vicinity of locally infected wounds, as venereal ulcers.

Scarifications are slight incisions, as with a scalpel, made upon inflamed parts to relieve the engorged capillary vessels. They are *employed* with benefit in *acute tonsillitis*, and in *conjunctivitis* with much chemosis and swelling. They are also serviceable in the treatment of *acne indurata* by puncture and should be followed by a stimulating lotion. Made upon the tympanic membrane and avoiding perforation a few cuts afford relief in *acute myringitis.* As scarifications given vent to effused fluids they may be used to let out the superficial dropsy of *chronic Bright's disease.*

3. **Setons** (*setacea*) and **Issues** (*fonticuli*) were employed when a permanent counter-irritant effect was desired. They are now not much used.

4. **Bandages** are employed, in the practice of medicine, to promote the absorption of *dropsical effusions*, and solid *inflammatory exudations.* For the same purpose strips of adhesive plaster may be applied to the chest, in *chronic pleurisy* and *empyema*, in the manner in which they are employed in the treatment of fractured ribs. The elastic bandage is used to promote the absorption of fluid in *diseases of the bursa.*

5. **Frictions** are used as revellents and as local stimulants. They may be employed either with the dry hand or with horse-hair gloves, or with liniments. The latter, applied with a sponge, are serviceable in *lumbago*, *sciatica*, *chronic rheumatism*, and *affections of the joints;* rubbed on the chest in *acute bronchitis* they often afford relief. As a local stimulus in *anidrosis*, frictions tend to re-establish the secretion of the sweat.

6. **Acupuncture** consists in the introduction into the body of fine, well-polished, sharp-pointed needles; they are introduced by a rapid rotary motion. This is a remedy occasionally used though a painful one, in *chronic rheumatism*, *neuralgia*, *balanitis* and *paralysis*. By the use of *insulated* needles a galvanic current may be conveyed to deeply-seated nerves. For purposes of counter-irritation a form of acupuncture is now used termed *Baunscheidtismus*. In this, an instrument is employed consisting of a heavy disk about half an inch in diameter, having inserted in it about twenty-five sharp needles, each about nine-sixteenths of an inch in length. To this disk is attached a strong wire spiral spring five and a half inches in length, and the other extremity of the spring is inserted in an elongated spindle-shaped handle, the spring and needles being contained in a cylinder, with the handle attached. In applying the instrument the open extremity of the cylinder is placed upon the skin; the handle is drawn up, and when this is suddenly loosed the needles are driven into the skin, the punctures being afterward rubbed with diluted croton oil or other irritant.

7. **Pneumatic Aspiration** is the employment of an instrument termed an ASPIRATOR (invented by Dieulafoy) for the removal by suction of pathological fluids.

The aspirator consists of:—

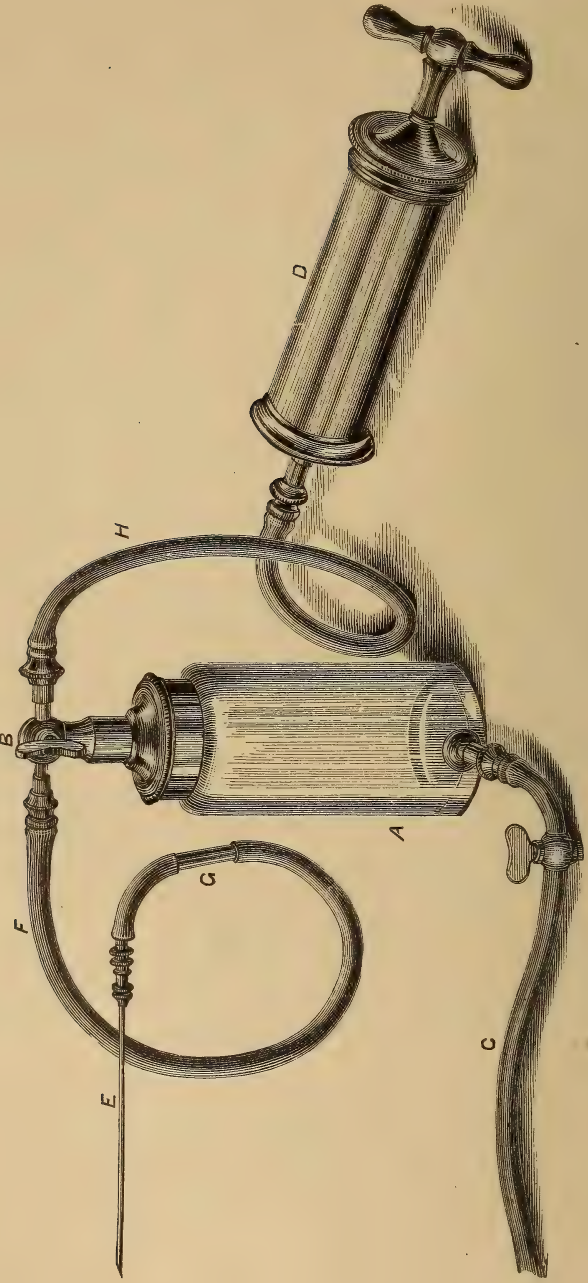
1. A glass-bottle or reservoir, A, mounted with a two-way stop-cock, B, and having an opening at the bottom for the insertion of the tube, C.
2. An exhausting syringe, D, with elastic connecting-tube, H.
3. A tubular needle, E, to be attached to the reservoir by an india-rubber tube, F.

A syringe and stop-cock for injecting astringents or other fluid is supplied if desired. The stop-cock is, in such cases, fixed to the tube F at its junction with the stop-cock B. Thus the tube can be detached from the aspirator without any chance of air entering the morbid cavity.

DIRECTIONS FOR USE.—Adjust the aspirator as figured in the diagram, with the stop-cock B turned vertically, that is, open to the bottle; close the stop-cock in the tube C, and form a vacuum by a few upward and downward movements of the piston of the exhausting syringe D.

Insert one of the needles beyond the two eyes, attach tube F to it, turn the stop cock B toward the needle, namely, horizontally,

FIG. I.



and continue the insertion of the needle until fluid is seen to flow through the short glass-tube G into the reservoir.

To empty the latter, turn the stop-cock B vertically, detach the syringe tube, and open the stop-cock in the tube C.

The presence of fluid having been established by the use of one of the fine needles, it is recommended, for more quickly emptying the cavity, to use one of the larger needles or trocars.

The introduction of the needle into the tissues requires some precautions. In place of endeavoring to penetrate by pressure, as with an ordinary trocar, it is preferable to combine pressure with rotation, by taking the needle in the forefinger and thumb and rolling it between them. Such a manœuvre is rendered necessary by the extreme fineness of the needle, which would be liable to bend or twist if driven in by direct pressure. Before using a needle it is well to be assured of its permeability.

Aspiration has been employed with safety and success, when other means have failed, in the removal of intrathoracic effusions as in *chronic pleurisy*, *empyema*, and *pericarditis*; of the fluid of *hydrocephalus*, *spina bifida*, *ascites*, *hydrothorax*, *cysts*, *abscess of the liver*, *hydrocele*, *synovitis*; diseases of the *bursæ*, and *dropsical effusions* generally as those of *chronic Bright's* disease. It is also applicable to the diagnosis and treatment of morbid fluids. Its use, too, avoids the formation of a disfiguring scar, as in the withdrawal of pus from a *bubo*.

Aspiration should be done under strict antiseptic precautions.

PART II.

IMPONDERABLE REMEDIES.

UNDER this head are included LIGHT, HEAT, COLD, ELECTRICITY, and MASSAGE.

1. **Light** (*Lux*) exercises an important influence in the organized world as a vivifying stimulus. It is useful as a therapeutic agent, in diseases dependent on imperfect nutrition and sanguification; and the exposure of the surface of the body to its action, as far as nudity is compatible with proper warmth, promotes the regular development and strength of the organs. On the other hand, in many diseases the action of light is injurious, and *darkness* is resorted to as a sedative and tranquillizing agent.

2. **Heat** (*Calor*), applied to the human system in moderate amount, acts, both locally and generally, as a stimulant; in intense degree it destroys vitality and organization. It is employed as a *local* excitant and revulsive, by means of hot bottles, hot bricks, and the hot foot-bath, as in *collapse;* in *facial palsy* when due to cold applied to the side of the head; and as an application to painful and inflamed parts in the form of elastic bags containing hot water; and of poultices and fomentations. Hot water introduced into the auditory canal will often stop the pain of that symptomatic condition known as *earache;* injected into the uterus it is a method of treatment sometimes of value in *endometritis*, and is likewise occasionally used in *metritis;* and as an injection in female *gonorrhœa.* As a general application heat is resorted to in the form of the water-bath and vapor-bath. CONTRAINDICATIONS: All baths are unsuitable for the asthenic, and are to be avoided by those affected with fatty heart, and who have a tendency toward apoplexy. Cold baths are particularly to be shunned if they cause chilliness afterward. The *warm bath*, at a temperature of from 92° to 98° F. is used as a relaxant in *dislocations*, *herniæ*, *spasm*, *infantile convulsions*, *croup*, etc., and also for its action on the joints in *rheumatic*, and upon the skin, in *chronic cutaneous affections—rheumatic arthritis* and *anidrosis*, for example. The *hot bath*, which may be either the plunge hip or sitz, has a temperature of from 98° to 112° F., or even higher, and is a powerful excitant in cases of *exhaustion* and *asphyxia;* it alleviates the strangury of *acute cystitis* and *gonorrhœa*, and is employed also in old *paralytic* and *rheumatic cases.* Hot water, introduced with a Davidson's syringe, is an efficient styptic in *uterine hemorrhage;* injected into the vagina before an operation on the perineum or cervix, or applied to wounds during a surgical operation, it is a good means of avoiding *hemorrhage.* In *amenorrhœa* hot sitz-baths, taken a few days before the expected period, are sometimes efficacious in re-establishing the menstrual flow. The *chafing of tender feet* may be avoided by soaking them in hot water containing a small lump of potassium nitrate. Immersion in the hot bath is one of the best means of alleviating the severe pain attending the passage of *biliary* and *renal calculi*, to prevent an attack of *laryngismus stridulus*, to facilitate the urinary flow combined with a full dose of opium in *retention*, and lastly as the plunge or hip in the management of *endometritis.* Tepid alkaline baths are serviceable to soften and remove the crusts and scales of various cutaneous

affections, for instance, *ecthyma*, *prickly heat* and *psoriasis*, to which may be added a little carbolic acid. The *hot-air-bath*, at a temperature of from 98° to 130° F. is useful as an excitant, diaphoretic and revellent, and is employed in cases of internal congestion, to produce vicarious action from the skin, where the secretion from other organs, as the kidneys, is more or less suspended, notably in *chronic Bright's disease*, and in rheumatic and cutaneous affections, particularly that of *anidrosis*, for the purpose of re-establishing the secretion of the sweat.

When desirable to employ hot baths for a prolonged period, conjoined with change of climate and scene, those of the *Hot Springs*, Arkansas; *Las Vegas*, New Mexico; and *Bath County Hot Springs*, Virginia, should not be lost sight of. These waters are often beneficial when other measures have failed in *gout*, *chronic rheumatism*, *stiffness of the joints*, *paralysis*, without organic lesion, *secondary and tertiary syphilis* and *neuralgia*. They render aid, too, in such cutaneous affections as *lichen*, *psoriasis*, *phthiriasis*, and *chronic eczema*. The temperature of the Arkansas Springs varies from 93° to 150° Fahr., and there are 57 springs from which the thermal waters flow in abundance. They contain small quantities of mineral matter, but only to the extent of gr. 7¾ to the gallon, composed chiefly of calcium carbonate and silica. The temperature of the Las Vegas Springs ranges from 123° to 130° Fahr.; the mineral constituents of this spring being principally sodium chloride and sulphate. The Bath Springs vary from 100° to 106° Fahr. Experience has proven that the waters of the Hot Springs of Arkansas are injurious in maladies of the brain, heart and lungs.

The destructive agency of heat is resorted to for the purpose of *vesication*, as by the application to the skin of the metallic plate heated to 212° by immersion in boiling-water; and of *cauterization*, by the employment of red-hot iron, or of moxa. Hot iron (known as the *actual cautery*) is used chiefly as a styptic, but also as a revulsive as when applied to the spine in *spinal irritation*. The term *moxa* is applied to small masses of combustible matter (as cotton-wool), which are burnt slowly in contact with the skin, with a view to a revulsive effect in deep-seated inflammations, nervous affections, etc.

3. Cold (*Frigus*).—The application of cold to living bodies produces a reduction of the temperature and volume of the parts, with contraction of the blood-vessels and other tissues, and suspension of the secretions and exhalations. The application of excessive or prolonged cold is followed by torpor and death of the parts. When it is applied in moderation and for a short period, reaction generally takes place, with a return and even increase in temperature, volume, color and sensibility.

Cold is employed therapeutically, with a view to both its primary and secondary effects. The *primary* action of cold is used: 1. To lessen vascular and nervous excitement and preternatural heat, as by the use of cold lotions and spongings in *fevers*, the ice-cap in *cerebral affections*, the shower-bath in *insanity*, the bladder filled with ice to the spine in *epilepsy*, the ether spray to the spine in *chorea*, etc. 2. To constringe the tissues, promote the coagulation of the blood and lessen the volume of parts; hence the local application of ice- or cold water to abate *inflammation* and check *hemorrhage*. 3. To produce local *anæsthesia* in surgical operations, by means of a freezing mixture topically applied.

The *secondary* effects of cold are obtained by the employment of a less intense degree of cold. They are resorted to: 1. To invigorate the system, as with the cold shower-bath and plunge-bath. 2. To rouse the system, as by cold affusions in *coma*, *asphyxia*, *syncope*, and the *narcotism* from opium, chloroform, hydrocyanic acid, alcohol, etc. 3. In spasmodic diseases, as *laryngismus stridulus*, *chorea*, etc. 4. To recall the vital properties to frost-bitten parts, as *chilblain*. 5. To effect local excitation, as by the application of the cold douche to *rheumatic* and *paralyzed* limbs.

The cold bath, or packing in a cold wet sheet, at 60°–70° F., is employed with much advantage in *sunstroke*, and in *fevers* where the temperature of the body is very high, as *scarlet fever*, *typhoid fever*, *acute rheumatism*, and, generally, to reduce excessive hyperpyrexia. When the cold wet sheet is employed, it should be well wrung out of cold water, wrapped round the patient, and all enveloped in a thick blanket.

The ice-bag is sometimes applied along the spine in convulsive diseases, as *epilepsy*, *tetanus* and *infantile convulsions*, as well as *spinal irritation* and *myelitis*, and over the kidneys in *hematuria*.

Compresses, wrung out of cold water or the ice-bag, are efficient local applications in relieving pain, as when applied to the head in *cerebral hyperemia* and *meningitis*, and to antagonize the inflammation of *sprains* and *synovitis*. Bathing the eyes frequently in cold water will allay photophobia as that of *keratitis* and *conjunctivitis*.

Cold liquids and ice are taken into the stomach as refrigerants in *fevers*, the latter to allay the thirst of *cholera*, *cholera infantum* and *peritonitis*. They are introduced into the rectum and vagina to check *hemorrhage* and allay irritation; and cold water, injected into the impregnated uterus, is among the most certain means of inducing premature delivery. *Chordee* may be checked by the application of a bottle of ice-cold water to the perineum. Baths are also useful in promoting the elimination of mineral poisons, as lead and mercury.

4. **Electricity** (*Electricitas*), from ἤλεκτρον, amber. "Electricity is now regarded as a force co-related to the other great forces of nature —heat, light, etc.—and, like them, is simply a mode of motion—a force of vibration." (Beard and Rockwell.) The electric current acts as an excitant to the nerves, both of sensation and motion. It influences also to some extent the secretions, through its action on the nerves distributed to the secreting organs; it may promote the function of absorption, through an effect on the absorbents; and it affects the circulation by inducing contractions of the heart and of the coats of the vessels. Faradization of the peripheral ends of the cut pneumogastrics stops the action of the heart; of the central ends, it causes retarded action and reduced blood-pressure. A powerful charge of electricity produces violent and frequently fatal effects on the central nervous system.

For medical purposes electricity is obtained from three sources:—

1. FRICTION or STATIC electricity.
2. GALVANIC electricity.
3. FARADIC, INDUCED, MAGNETIC or VOLTAO-MAGNETIC electricity.

FRICTION electricity may be applied in three modes:—

1. By the electric bath, when the patient, placed upon an insulated stool and connected with the prime conductor of an electrical machine, is *charged* with electricity.
2. By a *spark* to a particular spot; or,
3. A *shock* through a charged Leyden jar may be directed through the part which it is desired to affect.

GALVANISM is that form of electricity which is developed by chemical decomposition, and is known as the continuous, voltaic, or *battery* current. It is characterized by relatively low intensity of action, but is developed in considerable quantity, and produces chemical and thermic results that are not reached by the friction electricity. When the current of any form of electricity is applied to the body, it passes between the electrodes along the line of least resistance, which is for the most part a direct one. The continuous flow of the galvanic current through a motor nerve, unless the current be strong, is not followed by contractions of the muscles supplied by the nerve. Such contractions are only induced when the current is closed or broken. Upon the involuntary muscles, as the intestinal, the galvanic current causes slow and continuous contractions during the passage of the current. Hence the rationale of the use of galvanic electricity for the purpose of increasing peristaltic movements in constipation. The galvanic current stimulates the sensory nerves, causing a prickly sensation, the point of contact of the cathode with the skin being felt the most. When the current is much increased the sensation passes into a burning feeling which after a time diminishes at the anode. Upon the gustatory nerve the passage of the current through the tongue produces a metallic taste. The precise effect of galvanism upon the brain is not well understood, but it evidently penetrates the cerebral substances, for when the positive electrode is applied to the occiput, and the negative upon the forehead, an increased blood-supply to the head follows. Should the current be of sufficient strength vertigo will ensue. Galvanism of the cord induces muscular contractions, hence it is inferred that the current penetrates within its substance, at least as far as the motor cells.

FARADIZATION, or INDUCED electricity, is applied by means of electro-magnetic machines, their principle depending on the passage of a battery-current through an insulated wire helix (primary coil) wrapped round a soft iron bar, which becomes magnetic by induction. Around this helix a fine insulated wire is coiled (secondary coil), which has no connection with the battery or primary helix, and which receives electricity by induction from the latter. Closure of the current magnetizes the bar, which, in turn, attracts the rheotome, thus breaking the flow, the bar then becomes demagnetized, the rheotome flies back by its own elasticity, and in this way an interrupted current is obtained. The polarity of the induced current changes with each make and break of the circuit, and of course is inconstant, because its direction is constantly alternating; hence no chemical action is set up. If the interruptions be rapid enough, they cause apparently continuous muscular contractions.

The *primary current* is taken from the inner helix; the *secondary* from the outer. The shocks from the primary are much the weaker. The electrodes are the means by which the positive and negative electricity emerge from the battery; the positive pole, or *anode*, being connected with the negative element, and the negative pole, or *cathode*, with the positive element. A *stabile* application is one in which the electrodes are kept in a fixed position; in a *labile* they are shifted from point to point. Before use they should be moistened to increase their conductivity, as the skin is a bad conductor. The larger the electrode the greater will be the conductivity of the skin; on the other hand, to electrilize the skin alone, small metal electrodes should be used. Magneto-electricity is inferior in chemical and thermal influence to galvanism, but it produces more marked muscular contractions, and a more decided action on both the sensory and motor nerves. It has been shown by DuBois-Reymond that it is not the sum total of the density of the current passing through a motor nerve that stimulates it, but that such stimulation is due to change of density. Now the faradic current is made up of numerous currents of short duration, which are closed and opened at each swing of the vibrator; consequently the change of density is abrupt, and the more suddenly these changes take place, the stronger will be the muscular contractions. Upon the involuntary muscles the faradic current produces slower and more continuous contractions than upon the voluntary, the slower the interruptions the more powerful the contractions. It is by this peculiar action of diminishing the size of muscular fibre, that faradization becomes so serviceable in reducing the dimensions of the uterus after parturition. Upon the sensory nerves the faradic current produces a prickly, smarting sensation with each break of the rheotome, varying in intensity with the strength of the current. The brain substance, as shown by Erb, is readily affected by galvanism from the exterior, for when the electrodes are applied to the mastoids, flashes of light and vertigo are experienced; but, according to Althaus, the former phenomenon is due to excitation of the fifth nerve.

Electricity is employed in medicine for *diagnostic* and *therapeutic* purposes. Thus, in the diagnosis of spinal paralysis: when a muscle is merely separated from the influence of the spinal cord by destruction of its nerve, or by destructive disease of the cord at the origin of its nerve, it loses its electric irritability to all forms of electric irritation. Diminution of electro-excitability is found in *loco-*

motor ataxy of long standing and in diseases affecting the white matter of the cord; in *transverse myelitis;* in spinal affections that come under the orthopædic surgeon's hands; and lastly in muscles out of use from fracture, chronic joint troubles, etc. In cerebral paralysis, on the other hand, there is no diminution in the contractility of the paralyzed muscle by the electric current, and there may be even an increase. An increase, too, is sometimes noticed in the early stage of *locomotor ataxy*, and it is constantly found in certain kinds of spasm, as tetanus. In *malingering*, real may be distinguished from feigned paralysis, as, after railway accidents, faradization, by showing a marked difference in the contractility of the two sides, establishes the fact of an actual morbid condition.

In *facial palsy* the diagnostic value of electricity is typically evinced. Thus, the muscles respond scarcely, or not at all, to the faradic current in this condition, while the galvanic current will induce normal, or nearly normal, contractions.

In recent *hysterical* paralysis the contractility of the muscles is unimpaired.

Medicinal Uses.—Electro-therapeutics remains yet on a basis more or less unsatisfactory. As a general statement its effects are not called in till other means have failed, consequently it is often given in conditions which no measures could benefit. Still, when correctly applied and limited to suitable cases, it is incontestably an agent capable of accomplishing much good. Electricity may be employed either to arouse or increase the action of a nerve or muscle, as in *paralysis* of sensation or of motion, to relieve the pain of the various *neuralgiæ*, and to counteract *spasm*, as *torticollis* and *facial spasm*, either tonic or clonic. For the latter galvanism is mostly used, the positive pole being connected with a large plate-electrode which is placed over the spastic muscles, while the negative is applied over a neutral point in the median line of the body. It is chiefly available in cases of local or of purely functional palsy, as facial, and paralysis produced by alcohol, which are independent of central lesions; or in *lead palsy* after the elimination of the lead from the system. In the latter condition, which usually affects the extensors of the wrist and fingers, a good plan of treatment is to apply one large flat electrode over the junction of the cervical and dorsal vertebræ, the other to the sternum. The current should be sent in both directions, and when the polarity is changed it should be weak at first. It may be necessary, too, to galvanize separately the palsied muscles.

In the treatment of *facial palsy* the positive pole of the galvanic current is to be placed over the point of exit of the nerve below the ear, the negative on the terminal nerve-filaments which should be applied labile to the motor points about the face with a small electrode and the current interrupted frequently. It ought to be just strong enough to produce moderate contractions. Should these be readily obtained the prognosis is good. Galvanism gives the most satisfactory results when the palsy is due to peripheral neuritis, caused, it may be, by an effusion into the nerve-sheath, the result of a blast of cold air upon the face.

Lumbago, *neuralgia*, *muscular* and *chronic rheumatism*, and *migraine* are frequently benefited by a course of electricity. For the relief of *neuralgia* a good plan is to place the cathode over the origin of the diseased nerve, the anode to the seat of pain and a current of moderate power passed through for three or four minutes. Where there are distinct painful points the anode should be thoroughly applied. Sudden interruptions of the current are to be avoided. If galvanism fail, the faradic current should be tried. While there are no positive indications as to choice of battery, Rockwell gives the following rule for making the selection: if pressure aggravate the pain, galvanism is indicated; if not, faradism is the proper form.

In the treatment of *chronic rheumatism* electricity is often successfully employed. Either of the three forms of current may be given. When the faradic battery is used, the current should be passed, gradually increased, through the seat of pain, two or three daily séances being allowable. If the galvanic form be the selection, the cathode should be applied to the painful spot. According to W. H. King static electricity is the most successful in the relief of this affection.

In *migraine* a current of medium strength should be passed from the nape of the neck to the epigastrium; in addition, a longitudinal current is to be sent through the head by applying the anode to the forehead or eye-lids, the cathode to the occiput. The séances may last from five to ten minutes. The best that can be said in favor of electricity in sick headache is that it is only palliative, rarely curative. If galvanism fail, the faradic current should be tried.

Galvanism in *exophthalmic goitre* has been successfully given. Beard and Rockwell's method for electrilizing the sympathetics, the usual points of application, is to place the cathode over the seventh cervical vertebra, the anode to the auriculo-maxillary fossa, and with the latter stabile and labile applications are to be made at the fossa and along the inner edge of the sterno-mastoid muscle. After this has been accomplished, the anode is to take the place occupied by the cathode and the latter applied to the solar plexus, through which points a strong current is to be passed for one or two minutes.

In *writer's cramp* of recent origin, good results may be expected from galvanism which should be employed in conjunction with massage and gymnastic exercise. The anode is to be applied to the middle cervical vertebræ, and the cathode over the affected muscles through which a current of moderate strength should be sent daily. The séances should last from five to fifteen minutes, care being taken to regulate the power of the current, for this as in other cases, to the needs and condition of the case.

For the relief of *sciatica*, an affection often so obstinate, various plans of electrization both by galvanism and faradism are in vogue. One is to apply the cathode at the origin of the nerve with stabile applications of the anode in the vicinity of the pain; or two small electrodes may be used to pass the current at short range through segments of the affected parts of the sciatic nerve; or a large anodal plate may be applied to the sacrum, and with the cathode the current successively sent along the nerve and its painful branches. Whatever be the plan adopted, it should be combined with suitable hygienic and medicinal measures.

Though by no possible construction can electricity be regarded as a cathartic, yet by its peculiar excitant effect upon the involuntary muscular fibre it sets up peristaltic action and so brings about an evacuation from the bowels; hence it is advantageously applied for the relief of *constipation*. Place one electrode at the anus and with the other go over the abdomen, using a current as strong as can be borne, until intestinal peristalsis can be detected by applying the ear to the abdomen. The galvano-faradic is the best form, but the faradic will do.

Spermatorrhœa, *urinary incontinence*, and *impotence*, when functional, are not infrequently amenable to relief by electrization. It may be employed by applying a large plate electrode to the lumbar or sacral regions, and with a disk electrode covered with soft sponge, make labile applications to the perineum, groins and genitals; or the current may be passed through the urethra to the perineum by introducing it with a Neuman sound-electrode, the bulb of which is brought into contact with the neck of the bladder. Moral treatment must not be lost sight of in the first named affection. In impotence, should the testicles and penis be cold and relaxed the current may be advantageously sent through them.

During the attack of *angina pectoris* successful results have been obtained with the galvanic current by placing the anode over the præcordial region and going over the sympathetics and spine from the occiput downward with the cathode. The current should be weak at first and gradually increased.

The management of *hysteria* with electricity meets with varying success, but no method of treating this condition will be of avail unless supported by appropriate moral influences. According to King static electricity yields the best results, perhaps due to the mental effect produced by the brilliant spark. Electricity with other measures enters into the Weir Mitchell plan of treating neurasthenic disorders (see p. 52).

In cerebral *anemia* faradization, one electrode the anode, brought in contact with the occiput and the cathode to the forehead, since experience proves that passed in this way the current causes an increased supply of blood to the head, has frequently been successfully employed. Weak currents should at first be used and the body generally may be advantageously galvanized.

Faradization is often satisfactorily given in *apoplexy* the current to be applied to the paralyzed muscles with galvanization to the damaged portion of the brain. The results are, however, quite uncertain. The time to begin the cerebral application will be about one month after the attack, and it should not be persevered in beyond one week if no benefit be apparent. As the effect of the current upon the clot seems to be catalytic it should be passed through the brain in the direction where this is supposed to be located. The application of the positive pole should be mostly on the side of the lesion, but precise rules have not yet yet been formulated as to where it is best applied.

Faradization deserves mention as a *galactagogue*. If there be evident lack of development of the mammary glands it should be begun before pregnancy. When given at any period the current is to be passed through the breasts for about ten minutes. General faradization with other measures may likewise be called in to induce lactation.

But little can be said in favor of electricity in dermal therapeutics, though good results are claimed for it in *chronic eczema* (Rothwell), one pole of the galvanic current being applied to the nerve supplying the diseased part, and with the other labile applications are to be made to the eruption. In anemic and hysterical *paralysis*, as hysterical *aphonia*, static electricity is often very useful, and in *amaurosis*, under many circumstances, faradization will be of benefit.

Electricity has also been prescribed as an emmenagogue, to produce uterine contraction in *post-partum hemorrhage*, one pole to the abdomen over the uterus, the other to the lumbar region; in testing for life or death; and to promote the biliary secretion.

In the form of galvanism, one pole to the rectum, the other over the abdominal tumor, electricity is employed to destroy the fœtus in *extra-uterine pregnancy*, provided fœtal life has not advanced too far. It has also been advantageously used to promote the absorption of indurations and *fibroid tumors*. To accomplish this purpose there are two plans of application to select from, one being the passage of the current through the tumor by means of an electrode placed within the uterine canal; the other by introducing an electrode-needle into the tumor to which the battery is attached. By the former method a strong current must be used. Electro-magnetism is a powerful excitant in the *coma* of narcotic poisons, and in *asphyxia* generally it is probably the most active remedy that can be exhibited.

ELECTROLYSIS.—"This is a term applied to the process of decomposing substances by electricity." It is used with decided success to remove *superfluous hairs* from the face and other parts. Pitzer recommends the following procedure: an ordinary galvanic battery of 10–15 cells is required, with a fine needle, which is attached to the negative pole. The needle is inserted within the hair-follicle and the current closed with the positive electrode, causing a stinging sensation at the point of insertion; the hair should then be withdrawn with forceps; thirty to fifty hairs can be removed at one séance.

Electrolysis has been used in the treatment of internal *aneurism*, but with a measure of success only. One or more needles connected with the positive pole are inserted within the sac in the hope of forming a clot by the ensuing electrolytic action of the current on the blood. The negative pole is to be applied to the shoulder, the current turned on slowly, and the séance should last about twenty minutes. Statistics show that the smaller the artery the greater the chance of occlusion. The chief dangers are hemorrhage and the detachment and drifting into the blood of coagula.

In *urethral stricture* the galvanic current in a certain proportion of cases effects a cure. Mild currents must be employed and applied to the seat of constriction per the negative pole by means of conical-metal bulbs attached to bougies.

Galvano-cautery.—This is a method of cauterization in which a wire-loop or other suitable cauterant is heated by the galvanic current. Experiment has shown that the heat developed in a wire by a current is proportional to the squares of the quantity of electricity flowing through it and to the resistance of the wire.

Platinum, on account of its great resisting power, is the kind of wire selected. The chief advantages of the galvano-cautery are: easy application to inaccessible parts, absence of hemorrhage, and comparatively little pain. It is employed as a cauterant in various ways, as to stop *hemorrhage* during an operation, to remove the hypertrophied tissues in *chronic nasal catarrh*, etc.

5. **Massage.**—This is a word derived from the Greek, *μάσσω*, I knead; Arabic, *mass*, press softly. Massage has been in use by the ancients from time immemorial. It is now defined to mean a series of digital and manual movements applied to the body for therapeutic purposes, and by some authors is designated mechano-therapy. There are four kinds of movements in vogue, viz., *Effleurage*, *Pétrissage*, *Tapotement, and Massage à friction.* The first consists in gentle centripetal palmar stroking of the surface; the second of picking up and kneading the soft parts with the fingers; the third of percussion with the fingers, hands or knuckles; the fourth of elliptical frictions in narrow circles.

The art or act of massaging consists in the suitable combination of these movements, and, in order to obtain their best therapeutical effects, should only be employed under medical advice, and administered by an expert. Inasmuch as action and reaction are equal, an individual cannot massage himself; moreover, there is an extraneous mesmeric influence involved, so conducive to its effectual performance, that renders this impossible.

Physiologically, massage produces a calming effect on the nervous system, stimulates the flow of the blood and lymph, affords gentle exercise to the muscles, facilitates absorption, and elevates the body temperature about 1°. It does, in a word, contribute to restoring the body to health by arousing to renewed and normal activity all the vital processes, and, unlike internal medication, is not followed by reaction, of whatever degree of severity.

Medicinal Uses.—Massage is employed frequently with advantage in a variety of obstinate affections where other measures have proved unsuccessful as *paralysis*, *writer's cramp*, *paraplegia* and *facial palsy*, *locomotor ataxia*, *chronic rheumatism*, *lumbago*, *neurasthenia*, *cachexiæ* and *spinal irritation.* In fact, whenever there is loss of power, stiffness, or pain in an accessible part, massage will nearly always afford relief. In chronic rheumatism, as in other affections where its employment seems advisable, a combination of massage with electricity will often be of benefit. In all cases the duration and frequency of the séances must be left to the discretion of the physician, and regulated by the nature of the disease.

As to the length of time required to accomplish definite results with massage, Eccles* finds that in one month's massage an increase of strength, body-weight and appetite, with ability to sleep and work well, may be expected. Massage of the abdomen, according to Rubens-Hirschberg,† increases the quantity of the gastric juice, lessens dyspeptic pains, and augments the urinary flow.

Even in health, after violent exercise, general friction of the body augments the vigor of the system, and consequently plays an important part in all methods of training.

Under this heading mention must be made of the *Weir Mitchell treatment* of *neurasthenic* disorders, which, in addition to massage, consists of isolation, rest, over-feeding, and electricity; and also of the

Swedish Movement cure, which is defined by Schreiber to consist "in presenting a resistance to the intended motion of the patient, either by the physician himself or by an assistant."

PART III.

PHARMACOLOGICAL REMEDIES.

Pharmacological Remedies, or Medicines, are substances not essentially alimentary, which, when applied to the body, so alter or modify its vital functions as to be rendered applicable to the treatment of diseases. PHARMACOLOGY, accordingly, treats of the physiological action of drugs. For convenience of study the action of medicines is divided into *local* and *internal:* they are termed *local* when applied directly to a part (cauterants, for example); *internal*, when the economy is affected, as by way of the stomach, rectum, or hypodermically. This division is arbitrary, since the local application of many substances eventually exerts an influence on the system.

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* *The Practitioner*, 1887, p. 401.

† *Bull. Gén. de Thérap.*, Sept. 30th 1887, p. 241.

The designation MATERIA MEDICA is, *strictly speaking*, limited to the consideration of the nature and properties of the remedies used in medicine. PHARMACY is the department of Materia Medica which treats of the collection, preparation, preservation, and dispensation of medicines.

To the student of medicine, the objects of examination in relation to medicines are—the sources from which they are derived; the mode in which they are prepared and brought to market; their sensible qualities, and also their chemical composition and relations; their physiological effects, or the effects which they are capable of producing in healthy individuals; their therapeutical effects, or those which they produce in morbid states of the system; and, lastly, the doses, modes of administration, and preparations (extemporaneous and official), under which they are administered.

To facilitate a uniform nomenclature and dispensation of medicines, authoritative works have been issued in different countries, termed Pharmacopœias. The Pharmacopœia of the United States was first promulgated by the authority of a convention held at Washington, in 1820, and it has since been revised decennially. It furnishes a list of articles which are in general use, describes tests for their purity where required, sets forth the weights and measures which are employed in dispensing and preparing them, and supplies formulæ for such preparations as should be kept in the shops, and which are thence termed *official*, from the Latin word *officium*, authority. "All the articles are arranged in a continuous alphabetical order," and in no instance is the dose given. A Dispensatory differs from a Pharmacopœia in containing the medical and physical history of the various substances with directions for dispensing the same; the Pharmacopœia is mainly restricted to the mode of preparing them; it is official, while the Dispensatory is not.

The articles considered under MATERIA MEDICA proper, or pharmacological agents, may be conveniently classified for the purpose of study under three divisions, viz.:

1. INORGANIC.
2. ANIMAL.
3. ORGANIC.

The *inorganic* embraces the metallic and non-metallic bodies of which the iron, lead, mercurial, iodic and various other salts and compounds constitute familiar examples. They do not call for particular notice here.

From the *animal* kingdom are obtained a large number of dissimilar agents, as musk, pepsin, pancreatin, cantharides, cochineal, spermaceti, wax, isinglass, besides such fatty bodies as suet, lard, lanolin, and cod-oil, all of which are duly described in their respective chapters.

The *organic* comprises the vegetable agents. In these are found various proximate principles upon the presence of one or more of which the activity of the plant depends. They are termed *alkaloids*, *resins*, *oleo-resins*, *gums*, *gum-resins*, *oils fixed* and *volatile*, *pectin*, *vegetable acids*, *glucosides*, *starch*, *sugar*, *ferments*, *bitter-extractives*, and *albuminous principles*.

The *alkaloids* are nitrogenous bodies so called from their resemblance to the alkalies, and consist of two kinds, the volatile and fixed. They have an alkaline reaction, a bitter taste, are insoluble in water, but mix readily with alcohol, are for the most part crystalline, and possess in a marked degree a similarity in structure to the compound ammonias. Their construction is not yet known, but there is good evidence for the belief that they are derivatives of single, double, etc., molecules of ammonia. Most alkaloids are precipitated from solution by tannic acid, and the iodides and bromides, which form with them salts of the alkaloids. Various artificial alkaloids have been formed to which the name *amines* is applied, *trimethylamine* being an example. The only volatile alkaloids in the Materia Medica are *conine* and *nicotine*.

The *resins* are non-volatile, brittle, solid bodies, found generally associated with the volatile oils in plant-life, and are thought to be mixtures of weak acids. By the oxidation of the volatile oil, or by distilling it, the resin is obtained. Resins are freely soluble in alcohol forming varnish. *Oleo-resins* are mixtures of a resin and a volatile oil. Resins that yield cinnamic or benzoic acids are termed *balsams*.

The *gums* are amorphous exudations from the stems of various plants, insoluble in alcohol, and which with water swell up to form mucilage. They are composed of two hydrocarbons, *arabin* and *bassorin*, which exist united as acids to magnesium, potassium, or calcium. *Gum-resins* are likewise plant-exudations and consist of gums, resins, and volatile oils in various proportions.

The *fixed oils* as castor, olive, etc., are chemical compounds of stearic, palmitic and oleic acids, united to the base glyceryl. They are obtained by expression. In the process of saponification the base is liberated as glycerin, the acidulous radical forming with the alkali, soap.

Volatile oils are mostly obtained by distillation from the flowers, fruit, seed, etc., and retain the odor of the plant whence they are derived. They possess a highly aromatic smell. They usually consist of liquid hydrocarbons mixed with solid oxidized hydrocarbons. Many of them are isomers of the oil of turpentine, and are hence called *terpenes*. When the liquid hydrocarbon is driven off by distillation resin is left behind.

Pectin is a peculiar body which imparts to plant-juices the property of gelatinization. It forms a large portion of Irish moss.

The usual *vegetable acids* are citric, tartaric, acetic and tannic, though many others are obtained from the vegetable Materia Medica. Citric and tartaric exist naturally in the juices of the fruits of various plants. Acetic, though found in minute proportion in nature, is an artificial product obtained by the destructive distillation of wood, or by the oxidation of ethylic alcohol in the presence of a nitrogenous ferment. Tannic acid, the astringent principle of galls, oak-bark, etc., is widely diffused throughout the vegetable kingdom and is obtained from galls by the agency of washed ether. The vegetable acids unite to form definite compounds with various bases. Tannic acid, though a glucoside, precipitates those bodies as well as the alkaloids, and forms with ferric salts, ink.

The *glucosides* are vegetable substances composed of carbon, hydrogen and oxygen, which may be resolved by the aid of ebullition, acids, alkalies or ferments into sugar by taking up the elements of water, at the same time a second body is formed which differs according to the substance acted on. Salicin and tannin are familiar examples of glucosides. Such neutral principles as elaterin and picrotoxin are classed with the glucosides, though of uncertain nature.

The remaining vegetable proximate principles do not call for special mention here. The ferments *emulsin* and *amygdalin* are noticed under oil of almonds and mustard; *sugar* and *starch* with demulcents; *bitter-extractive* with tonics.

MODUS OPERANDI OF MEDICINES.

The medium through which the influence of medicines is exerted on remote parts of the body, or their *modus operandi* (as it is usually termed), was long a contested point, but it is now generally admitted that the *absorption* or passage of the medicinal or poisonous molecules into the blood is necessary to their action on parts remote from the seat of impression. It was Magendie who first conclusively demonstrated that poisons act on the spinal cord through the circulation, and not by means of the lymph and nerves.

While, however, it is well established that the *characteristic* action of medicines is transmitted to the parts influenced, exclusively through the medium of the circulation, it is undeniable that the functions of the nervous system may be *secondarily* excited by a local medicinal impression. The number of agents which operate in this manner is, however, very limited.

The action of medicines by absorption is proved by a variety of facts.

They are detected in many parts of the system remote from that to which they have been applied, having been found in the blood, the solids, and the excretions, after being taken into the stomach. If the circulation be interrupted, the influence of a poison cannot be transmitted; while its effects have been obtained, when applied to a wound in the foot of an animal, after all parts of the extremity have been severed except the artery and vein. In confirmation of the doctrine of absorption may be cited also the admitted facts, that the remote effects of medicines or poisons are promoted or retarded by circumstances which promote or retard absorption; that the blood of poisoned animals is found to possess poisonous properties; that the fluids and solids acquire medicinal properties after the use of medicines (as the milk of nurses); that the specific effects of medicines are produced by their injection into the blood;

and that medicines disappear from closed cavities into which they are introduced.

After their absorption into the blood, medicines circulate with it, penetrate through the capillaries to the various organs, and are afterward thrown out of the system with the excretions. Some medicines produce changes in the condition of the circulating fluid. Others have a specific action upon some one or other of the organs of the body. And, in passing out of the system, most medicines act as excitants of the organs by which they are thrown out.

The absorption of medicines is effected principally by the capillaries, and in some degree also by the lymphatics and lacteals. The medicinal particles penetrate or soak through the interstices of the tissue with which they are placed in contact, and are thence diffused through the circulation. To a limited extent, medicinal substances probably penetrate all the tissues of the part to which they are applied, and in this way the activity of medicines is most decided upon the organs contiguous to the seat of application.

The absorption of insoluble substances cannot take place until they are previously rendered soluble. In the stomach, this is accomplished partly by the agency of the acids of digestion and partly by the albuminoid constituents of the gastric fluid. Some substances are dissolved by the alkaline liquids of the small intestine.

It is objected to the theory of the operation of medicines by absorption, that certain poisons act with a rapidity incompatible with their previous introduction into the circulation. This is, however, not the fact, as the action of the most violent poisons (hydrocyanic acid, for example) is never wholly instantaneous; and careful experiments have shown that the velocity of the circulation is sufficient to diffuse a poison through the blood in a shorter space of time than its effects are ever observed on the system.

CIRCUMSTANCES WHICH MODIFY THE EFFECTS OF MEDICINES.

The circumstances which modify the effects of medicines relate both to the medicines and to the human system.

1. The properties of medicines are modified by the soil in which they grow, by climate, cultivation, age, and the season of the year at which they are gathered.

2. Medicines are more active, because more readily absorbed, in a state of solution than in a solid state.

3. Soluble medicines are often rendered inert by a chemical reaction which converts them into insolubles, or by a physiological antagonism, exerted by some other medicine taken at or about the same time, which counteracts their effects throughout a part or the whole of their range of action; in this way chemical and physiological antidotes modify the effects of poisons. When the chemical composition of medicines involves their mutual decomposition, they are said to be *incompatible*.

4. Differences in dose greatly modify the effects of medicines.

5. Pharmaceutical modifications have an important influence on the efficacy of medicines. They may be exhibited in the solid, semi-solid, liquid and aëriform states.

In the *solid* state they are administered in the shape of abstracts, triturations, powders, pills, lozenges, confections and papers.

In the *liquid* state they are administered in the shape of mixtures, solutions, medicated waters, infusions, decoctions, tinctures, spirits, wines, juices, vinegars, honeys, syrups, fluid extracts, glycerites and oleo-resins.

In the *semi-solid* or soft state they are employed internally, in the form of suppositories and extracts; and externally in that of liniments, ointments, cerates, oleates, plasters and cataplasms.

In the form of *gases* and *vapors*, medicines are used for purposes of inhalation.

SOLIDS.

Abstracts (*Abstracta*) are solid preparations in the form of powder. They are twice as strong as the drug or the fluid extract, and are about ten times as strong as the tincture, and are alcoholic extracts, diluted with sugar of milk.

Triturations (*Triturationes*) are prepared by thoroughly triturating in a mortar, 10 parts of the medicinal substance with 90 parts of sugar of milk (which should be gradually added, and the process continued until the whole is thoroughly mixed and finely powdered).

Powders (*Pulveres*). The form of powder is usually selected for the administration of medicines which are not bulky, nor of disagreeable taste, have no corrosive property, nor deliquesce rapidly on exposure. Deliquescent substances, and such as contain a large proportion of fixed or volatile oil, should always be recently pulverized, as they deteriorate when kept. Most substances employed in the form of powder are usually pulverized on a large scale. For the purpose of pulverizing drugs in small quantity, the physician makes use of a *pestle* and *mortar*, the finer particles being afterward separated from the coarser by a sieve. In some cases, a stone-slab and muller are used. Some powders are obtained by *precipitation;* and the finer particles of a powder are often separated from the coarser by a process termed *elutriation*, in which the powder is diffused through water, the heavier portions being first allowed to subside, and the liquid being poured off, the finer particles settle separately. Volatile substances are often finely powdered by *sublimation* and by suddenly condensing their vapors.

Salts of difficult pulverization are often *granulated*, by making a hot saturated solution of the salt, and filtering and stirring the filtered liquid until cool. Of late years *granulated effervescing* salts have been used in imitation of the waters of mineral springs, the effervescence being produced by the addition of sodium bicarbonate and tartaric or citric acid.

Pills (*Pilulæ*) are small globular masses, of a semi-solid consistence, and of a size that can be conveniently swallowed.

The form of pill is suitable for the exhibition of medicines which are not bulky, and are of disagreeable taste or smell, or insoluble in water. Deliquescent substances should not be made into pills, and those which are efflorescent should be previously deprived of their water of crystallization.

Some substances are readily made into pills with the addition of a little water, spirit, glycerin, extract of gentian, or syrup. Very soft or liquid substances require the addition of some dry inert powder, as acacia, to reduce them to a proper consistence. Wax is a good excipient for oils.

Heavy powders are mixed with some soft solid, as confection of rose, plasma, manna, etc., or with a tenacious liquid, as treacle or syrup. When the pilular mass is properly prepared, it is rolled with a spatula into a cylinder of uniform thickness, and is then divided into the required number of pills, with the spatula, or, more accurately, with a pill-tile, or with a pill-machine. The pills are rolled into spherical form between the fingers; and, to prevent adhesion, are dusted with some dry powder, as powdered liquorice-root, lycopodium, orris-root, starch, or magnesium carbonate. They should weigh from one to four grains, unless metallic, when a weight of from six to eight grains is admissible; a large pill is termed a *bolus*. When long kept, pills may pass unchanged through the stomach and bowels, and are, therefore, objectionable. To conceal the taste and smell of pills, they are sometimes *coated* with gelatin, collodion, mucilage, sugar, etc. When they are designed to be of slow operation, the modern practice of sugar coating pills answers very well. But, when they are intended to act quickly, the coating is objectionable, as it retards the solution of the pills in the gastric fluid. *Compressed pills* are made without excipients, simply by subjecting medicinal substances to pressure in moulds; in this way, extraneous matter is avoided, and smaller bulk is secured. *Gelatin-capsules* are used to enclose disagreeable medicaments.

Troches or **Lozenges** (*Trochisci*) are small, dry, solid masses, made of powders with sugar and mucilage, and intended to be held in the mouth and allowed to dissolve slowly. Mucilage of tragacanth is usually employed in preparing lozenges.

Confections (*Confectiones*) are soft, solid preparations, made with some saccharine matter. They are subdivided into *Conserves* and *Electuaries*: the former consist of combinations of recent vegetable substances and refined sugar, beat into a uniform mass; the latter are extemporaneous mixtures of medicines, usually dry powders, with syrup, honey or treacle.

Papers (*Chartæ*) are preparations designed for external application, which are made by spreading mixtures of medicinal substances, as cantharides or mustard, upon paper.

LIQUIDS.

Mixtures (*Misturæ*) are preparations of *insoluble* substances suspended in water by means of acacia, sugar, the yolk of eggs, or other viscid matter. When the suspended substance is oleaginous the mixture is termed an *emulsion*.

Solutions (*Liquores*) are solutions (chiefly aqueous) of non-volatile substances, which are wholly soluble in the menstruum employed. In making solutions, and all other aqueous preparations, the water used should be fresh river, rain, or distilled water, and free from saline impurities.

Medicated Waters (*Aquæ*) are preparations consisting of water holding volatile or gaseous substances in solution. They are best made by distilling water from plants containing volatile oils, and are thence termed *distilled waters*. In place of distillation, trituration with magnesium carbonate (afterwards separated by filtration) is often employed to impregnate water with volatile oils; but the watery distillates have a more delicate fragrance and flavor.

Infusions (*Infusa*)* are partial solutions of vegetable substances in water, obtained without the aid of ebullition. They are made with both hot and cold water; the former extracts the soluble principles more rapidly and in larger proportion; the latter is preferred should the active principles be injurable by heat, or if it be desirable not to take up some matter insoluble at a low temperature. When the process takes place at a heat of from 60° to 90° it is termed *maceration;* when at a heat of from 90° to 100°, *digestion.* A more efficient mode of extracting the medicinal virtues of plants is *percolation* or *displacement.* In this operation, the medicinal substance is coarsely powdered and placed in a conical or nearly cylindrical instrument called a *percolator,* in the lower part of which is fitted a porous or colander-like partition or diaphragm. The powder is then saturated with water or other menstruum till it will absorb no more; and, after they have remained for some time in contact, fresh portions of the menstruum are added, till the required quantity is employed. The fresh liquid, as it is successively added, percolates the solid particles of the medicinal substance, driving the previously saturated liquid before it; and in this way completely exhausts the substance to be dissolved. An ordinary glass funnel answers very well for percolation; and a circular piece of muslin or lint, pressed into the neck by means of a cork with notched sides, forms a good diaphragm—care being taken to interpose a similar piece of muslin, moistened slightly with the menstruum, between the diaphragm and powder.

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*"An ordinary Infusion, the strength of which is not directed by the physician, nor specified by the Pharmacopœia, shall be prepared by the following formula:—

Take of

The Substance, coarsely comminuted, *ten parts*	10
Boiling Water, *one hundred parts*	100
Water, *a sufficient quantity*	
To make *one hundred parts*	100

Put the Substance into a suitable vessel, provided with a cover, pour upon it the Boiling Water, cover the vessel tightly, and let it stand two hours. Then strain, and pass enough Water through the strainer to make the Infusion weigh *one hundred* (100) *parts.*"—(U. S. P., 1880.)

Decoctions (*Decocta*)[*] are partial solutions of vegetable substances in water, in which the active principles are obtained by ebullition. This is a more rapid and efficient mode of extracting the virtues of plants than by infusion. But it is objectionable when the proximate principles are volatile at a boiling heat or undergo decomposition by ebullition. In making decoctions ebullition should be continued for a few minutes only, and the liquid should be allowed to cool slowly in a close vessel. As they are apt to spoil, they should be prepared only when wanted for use.

Tinctures (*Tincturæ*) are solutions of medicinal substances in alcohol or diluted alcohol. The aromatic spirit of ammonia and ethereal spirit are also sometimes employed as solvents; and solutions in these menstrua are called *ammoniated* tinctures and *ethereal* tinctures. Alcohol or rectified spirits (sp. gr. 0.820, U. S. P.) is employed in making tinctures of substances nearly or quite insoluble in water, as the resins, iodine, etc. Diluted alcohol or proof-spirit (equal weights of official alcohol and water) is preferred, when the substance is soluble both in alcohol and water, or when some of its ingredients are soluble in the one menstruum and some in the other. Tinctures have been usually prepared by maceration or digestion, more commonly by the former process, and a period of two weeks is recommended for its duration. It should be conducted in well-closed glass-vessels, which should be frequently shaken; and when the maceration is completed, the tincture should be separated from the dregs by filtration. The U. S. P. now recommends percolation in making most tinctures, and, in the hands of skilful pharmaceutists, this process is preferable, as the most thorough mode of exhausting medicinal substances; but, where the operator cannot trust himself, it is better to recur to the old process of maceration. Tinctures should be kept in bottles accurately stoppered to prevent evaporation, which might seriously increase their strength.

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[*] "An ordinary Decoction, the strength of which is not directed by the physician, nor specified by the Pharmacopœia, shall be prepared by the following formula:—

Take of

The Substance, coarsely comminuted, *ten parts*	10
Water, *a sufficient quantity*	
To make *one hundred parts*	100

Put the Substance into a suitable vessel, provided with a cover, pour upon it *one hundred* (100) *parts* of Cold Water, cover it well, and boil for fifteen minutes; then let it cool to about 45° C. (113° F.). Strain the liquid, and pass through the strainer enough cold water to make the product weigh *one hundred* (100) *parts*."—(U. S. P., 1880.)

Tinctures of Fresh Herbs (*Tincturæ Herbarum Recentium*). "These tinctures, when not otherwise directed, are to be prepared by the following formula:—

Take of

The Fresh Herb, bruised or crushed, *fifty parts*	50
Alcohol, *one hundred parts*	100

Macerate the herb with the alcohol for fourteen days; then express the liquid and filter." (U. S. P., 1880.)

The form of tincture is adapted to the exhibition of medicines which are to be given in small quantity, and it affords a convenient mode of graduating doses. In prescribing large and continued doses of tinctures, the stimulating effects of the alcohol which they contain must be borne in mind.

Spirits (*Spiritus*) are alcoholic solutions of volatile or gaseous principles, properly speaking procured by distillation, but now usually prepared by dissolving the volatile principles in alcohol or diluted alcohol. The spirits of the aromatic vegetable oils are used to give a pleasant odor and taste to mixtures, to correct the nauseating and griping effects of cathartics, and also as carminatives and stomachics.

Wines (*Vina*) are solutions of medicinal substances in stronger white wines.

Vinegars (*Aceta*) are infusions or solutions of medicinal substances in distilled vinegar or diluted acetic acid.

Honeys (*Mellita*) are preparations of medicinal substances in honey.

Syrups (*Syrupi*) are preparations of medicinal substances in concentrated solutions of sugar. The term *syrup* (*syrupus*), or *simple syrup*, is applied to a solution of sugar (65 parts) in water (sufficient to make 100 parts of syrup), dissolved with the aid of heat. *Medicated* syrups are usually made by incorporating refined sugar with vegetable infusions, decoctions, expressed juices, fermented liquors, or simple aqueous solutions. They may also be prepared by adding a tincture to simple syrup, and afterward evaporating the alcohol; or by mixing the tincture with sugar in coarse powder, and dissolving the impregnated sugar, after evaporation, in the necessary proportion of water. Syrups are apt to be spoiled by heat, and should be made in small quantities at a time.

Fluid Extracts (*Extracta Fluida*) have the advantage over solid extracts of convenience of administration, and of being prepared at a less degree of heat. In preparing them alcohol and glycerin are the menstrua chiefly resorted to. The portion of the solvent which remains after evaporation contributes in some degree to the preservation of the preparation. According to the U. S. P., 1880, 1 c.c. of the fluid extract represents 1 gm. of the drug—a decrease in strength of about 5 per cent. from the former standard.

Glycerites (*Glycerita*) are solutions of medicinal substances in glycerin, made by rubbing them together in a mortar.

The **Oleo-Resins** (*Oleo-resinæ*) are extracts obtained by the agency of ether, which consists of fixed or volatile oils, holding resins, and sometimes other active matters in solution. They retain a liquid or semi-liquid state upon the evaporation of the menstruum employed in their preparation, and have the property of self-preservation.

SEMI-SOLIDS.

Suppositories (*Suppositoria*) are soft solids, made by the mixture of a medicinal substance with the oil of theobroma, usually in a conical form, of a weight of 15 grains, and designed for introduction into the rectum. They are employed with a view both to a local effect on the lower bowel and also to the gradual absorption of the medicinal substance. As absorption from the rectum is slow, larger quantities are required than by the mouth.

Extracts (*Extracta*).—By the evaporation of the solutions of vegetable principles, a very useful class of preparations, termed EXTRACTS, is obtained. They are prepared from infusions, decoctions, tinctures and vinegars, and sometimes, in the case of recent vegetables, from the expressed juices of plants, usually diluted with water. Extracts prepared by the agency of water are termed *watery extracts;* those by means of alcohol, *alcoholic extracts;* those by means of acetic acid, *acetic extracts.* The evaporation of extracts is generally continued till they have a pilular consistence.

Liniments (*Linimenta*) are oily preparations designed for external use, usually thicker than water, but always liquid at the temperature of the body.

Ointments (*Unguenta*) are preparations of a consistence like that of butter, made with lard or some other fatty substance. They are fitted for application to the skin by friction or inunction. Most of the ointments become rancid when long kept, and it is therefore best to prepare them only as wanted for use. The term *ointment* (*unguentum*) is applied to a mixture of 20 parts of yellow wax and 80 parts of lard. *Petrolatum*, a substitute for vaseline, a straw-colored ointment made from petroleum, not decomposable, is a superior unguent for general purposes (see petrolatum).

Cerates (*Cerata*) are made of oil or lard, mixed with wax, spermaceti or resin, with the addition of various medicinal substances. They are of harder consistence than ointments, and do not melt when applied to the skin. The term *cerate* (*ceratum*) is applied to a mixture of 30 parts of white wax and 70 parts of lard.

Oleates (*Oleata*) are made by combining oleic acid with metallic bases or alkaloids. The combination is effected by rubbing them together in a mortar, and is generally aided by heat.

Plasters (*Emplastra*) are adhesive at the temperature of the body, and must generally be heated to be spread. Some substances have sufficient consistence and adhesiveness to be made into plasters. Usually, however, medicinal substances, when employed in this form, are mixed with *Lead-Plaster* or *Litharge Plaster* (*Emplastrum Plumbi*), a compound of olive-oil and litharge. Plasters are prepared for use by spreading them upon sheepskin, linen or muslin, with a margin a quarter or half-inch broad.

Cataplasms or **Poultices** (*Cataplasmata*) are soft, moist substances intended for external use. The common emollient poultice, employed to relieve inflammation and to promote suppuration, is made by mixing bread-crumbs with boiling milk or powdered flaxseed with boiling water (see poultices). A fabric termed *spongiopiline*, consisting principally of sponge, has been used as a substitute for the old poultice, and, when saturated with hot water, is a good vehicle of heat and moisture.

GASES AND VAPORS.

When employed in this form medicines are administered by *inhalation*. This may be effected either by diffusing the gas or vapor through the air to be respired by the patient; or by inclosing it in a bag or bottle with a suitable tube, through which the patient may breathe; or, when ethereal vapors are employed, by saturating a sponge or handkerchief with the ether and applying it to the mouth and nostrils of the patient; or the fumes of burning medicinal substances may be inhaled by means of cigarettes or pipes variously contrived.

WEIGHTS AND MEASURES

In prescribing and dispensing medicines the following are the *weights* and *measures* employed in the United States, with their signs annexed:—

TROY OR APOTHECARIES' WEIGHT.

The pound, ℔	contains	Twelve ounces, ℥.
The ounce		Eight drachms, ʒ.
The drachm		Three scruples, ℈.
The scruple		Twenty grains, gr.

The term *pound* should be avoided in formulæ, owing to the danger of mistakes from confounding the Troy pound with the heavier avoirdupois pound, and large weights should be expressed in *Troy ounces.* The scruple sign (℈) should not be used in prescribing, because of the liability of mistaking it for the drachm (ʒ). All weights of less than a drachm should be expressed in grains (gr.). The Troy ounce contains 480 grains; the drachm, 60 grains.

In France and other parts of the continent of Europe a system of *metrical weights* is employed, having for its unit the meter (39.37 inches), which is the ten-millionth part of the distance from the pole to the equator measured on any meridian. From this basis all other weights and measures are calculated. As all the divisions are obtained from the multiple ten, it is purely a decimal system. The names given to the different multiples and divisions of the unit are indicated by prefixes derived from the Latin and Greek.

FOR SUBDIVISION.

Latin	Milli	indicates the	$\frac{1}{1000}$	of the unit.
	Centi	" "	$\frac{1}{100}$	" "
	Deci	" "	$\frac{1}{10}$	" "

FOR MULTIPLICATION.

Greek	Deca	indicates	10	times the unit.
	Hecto	"	100	" "
	Kilo	"	1,000	" "
	Myria	"	10,000	" "

In the *metric system*, fluids as well as solids are expressed by weight, consequently the gram (unit of weight) and its decimal divisions enter only into the calculation of a prescription. A gram is the weight of a cubic centimeter of water at 4° C. The *subdivisions* of the gram are milligram, centigram and decigram; the *multiplications*, decagram, hectogram, etc. Instead of using the latter terms the total is better expressed in grams. The sign *Gm.* is used to denote gram; c. c., cubic centimeter, and to denote quantity, Arabic figures; the latter should precede the symbol. In prescribing liquids, allowance must be made for the relation existing between sp. gr. and bulk. In each case, of spirits, tinctures and oils $\frac{1}{10}$ less, of stronger ether $\frac{1}{4}$ less, of spirit of nitrous ether $\frac{1}{5}$ less, of glycerin $\frac{1}{4}$ more, of syrup $\frac{1}{3}$ more, of chloroform $\frac{1}{2}$ more, must be ordered. In the case of spirits and tinctures the difference being slight it may be disregarded. Rules for expressing quantity by weight of the Troy system in metric terms: A. Reduce the quantity to grains and divide by 15; the quotient expresses the quantity in grams (nearly). B. Reduce each quantity to drachms and multiply the number by 4; the product is the number of grams representing nearly the same quantity. These rules are to be employed in changing fluid measures to grams. In round numbers 1f℥ = 30 c.c.; 1 c. c. or *Gm.* = gr. 15 ½ of distilled water at 4° C. It has been suggested to use the term flui-gram for c. c. (Mann and Oldberg.)

Comparative Table of Decimal with Troy Weights.

Names.	Equivalent in Grams.	Equivalent in Grains.	Equivalent in Troy Weight.			
			℔	℥	ʒ	gr.
Milligram . . .	.001	.0154				$\frac{1}{64}$
Centigram . . .	.01	.1543				$\frac{1}{6}$
Decigram . . .	.1	1.5434				1.5
Gram	1	15.4340				15 4
Decagram . . .	10	154.3402			2	34.0
Hectogram . .	100	1543.4023		3	1	43.0
Kilogram . . .	1000	15434.0234	2	8	1	14.
Myriagram . .	10000	154340.2344	26	9	4	20.

WINE OR APOTHECARIES' MEASURE.

The gallon, C.	contains	Eight pints, O.
The pint		Sixteen fluidounces, f℥.
The fluidounce		Eight fluidrachms, fʒ.
The fluidrachm		Sixty minims, ♏.

The term *gallon* is not used by the U. S. Pharmacopœia, that measure being always expressed in pints.

Liquid measures are sometimes prescribed by *drops*, which, however, vary in quantity according to the nature of the liquid, the shape and size of the vessel from which they are dropped, and even the amount of liquid which the vessel contains. (Thus, a fluidrachm of distilled water contains only 45 drops, while this measure of alcohol and of most tinctures contains 120 drops, and of chloroform 220 drops, or even more.) Approximate measurements are also frequently employed in prescribing the less powerful liquids: thus a *teacup* is used for f℥iv, or a gill; a *wineglass* for f℥ij; a *tablespoon* for f℥ss; a *teaspoon* for fʒj; as these are uncertain, a graduated measure is preferable.

Table for Converting Cubic Centimeters into Fluidrachms.

Cubic Centimeters.	0.	1.	2.	3.	4.	5.	6.	7..	8.	9.
	dr. m.	dr. m.	dr. m.	dr m	dr. m.	dr. m.	dr. m.	dr. m.	dr. m.	dr m.
0	0	0 16	0 32	0 49	1 5	1 21	1 37	1 53	2 10	2 26
10	2 42	2 58	3 15	3 31	3 47	4 3	4 19	4 36	4 52	5 8
20	5 24	5 41	5 57	6 13	6 29	6 46	7 2	7 18	7 34	7 51
30	8 7	8 23	8 39	8 56	9 12	9 28	9 44	10	10 17	10 33
40	10 49	11 5	11 22	11 38	11 54	12 10	12 27	12 43	12 59	13 15
50	13 31	13 48	14 4	14 20	14 36	14 53	15 9	15 25	15 41	15 58
60	16 14	16 30	16 46	17 2	17 19	17 35	17 51	18 7	18 24	18 40
70	18 56	19 12	19 28	19 44	20 1	20 17	20 34	20 50	21 6	21 22
80	21 38	21 55	22 11	22 27	22 43	23	23 16	23 32	23 48	24 4
90	24 20	24 37	24 53	25 9	25 26	25 42	25 58	26 14	26 31	26 47

100 cubic centimeters are equal to 27 fluidrachms 3 minims, or 3 fluidounces 3 fluidrachms and 3 minims.

A variety of circumstances, relating to the human organism, modify the effects of medicines.

AGE exerts a most important influence in this particular. Children are more susceptible than adults; and in advanced age, also, smaller doses are required than in the prime of life. No general rule can be laid down for the adaptation of the doses of medicine to different ages, as the susceptibilities to the influence of different medicines are unequal at the same age. Thus, infants are peculiarly alive to impressions from opium, while in the cases of calomel and castor oil, they will bear much larger proportional doses.

Dr. Young's scheme for graduating the doses of medicines to different ages answers very well in prescribing: For children under twelve years, the doses of most medicines must be diminished in the proportion of the age to the age increased by 12; thus, at two years to $\frac{1}{7}$, viz.: $\frac{2}{2 \div 12} = \frac{1}{7}$. At 21 the full dose may be given.

Maisch's Table for Converting Apothecaries' Weights and Measures into Gram Weights.

TROY WEIGHT.	GRAMS.	APOTHECARIES' MEASURES.	GRAMS FOR LIQUIDS.		
			Lighter than Water.	Spec. Grav. of Water.	Heavier than Water.
Grain $\frac{1}{16}$	.004	Minim 1	.055	.06	.08
$\frac{1}{12}$	.005	2	.10	.12	.15
$\frac{1}{10}$	.006	3	.16	.18	.24
$\frac{1}{8}$	.008	4	.22	.24	.32
$\frac{1}{6}$	.010	5	.28	.3	.40
$\frac{1}{4}$	.016	6	.32	.36	.48
$\frac{1}{3}$	.02	7	.38	.42	.55
$\frac{1}{2}$	.03	8	.45	.5	.65
$\frac{3}{4}$	.05	9	.50	.55	.73
1	.07	10	.55	.6	.80
2	.13	12	.65	.72	.96
3	.20	14	.76	.85	1.12
4	.26	15	.80	.9	1.20
5	.32	16	.90	1.0	1.32
6	.39	20	1.12	1.25	1.60
7	.45	25	1.40	1.55	2.00
8	.52	30	1.70	1.90	2.50
9	.59	35	2.00	2.20	2.90
10 (℈ss)	.65	40	2.25	2.50	3.30
12	.78	48	2.70	3.0	4.00
14	.90	50	2.80	3.12	4.15
15	1.00	60 (fʒj)	3.40	3.75	5.00
16	1.05	65	3.60	4.0	5.30
18	1.18	72	4.05	4.5	6.00
20 (℈j)	1.3	80	4.50	5.0	6.65
24	1.5	90 (fʒiss)	5.10	5.6	7.50
30 (ʒss)	1.95	96	5.40	6.0	8.00
32	2.1	100	5.60	6.25	8.30
36	2.2	120 (fʒij)	6.75	7.5	10.00
40 (℈ij)	2.6	150 (fʒiiss)	8.50	9.5	12.50
45	3.0	160	9.00	10.0	13.30
50 (℈iiss)	3.2	180 (fʒiij)	10.10	11.25	15.00
60 (ʒj)	3.9	210 (fʒiiiss)	11.80	13.0	17.50
70	4.55	240 (fʒiv)	13.50	15.0	20.00
80 (℈iv)	5.2	fʒv	16.90	18.75	25.00
90 (ʒiss)	5.9	fʒvss	18.60	20.75	27.50
100 (℈v)	6.5	fʒvj	20.25	22.5	30.00
110 (℈vss)	7.1	fʒvij	23.60	26.25	35.00
120 (ʒij)	7.80	fʒviij (f℥j)	27.00	30.0	40.00
150 (ʒiiss)	9.75	fʒix	30.40	33.75	45.00
180 (ʒiij)	11.65	fʒx	33.75	37.5	50.00
240 (℥ss)	15.5	fʒxij (f℥iss)	40.50	45.0	60.00
300 (ʒv)	19.4	fʒxiv	47.25	52.5	70.00
360 (ʒvj)	23.3	f℥ij	54.00	60.0	80.00
420 (ʒvij)	27.2	f℥iiss	67.50	75.0	100.00
480 (℥j)	31.1	f℥iij	81.00	90.0	120.00
℥ij	62.2	f℥iiiss	94.50	105.0	140.00
℥iv	124.4	f℥iv	108.00	120.0	160.00

A good practical rule for graduating doses is that of Dr. Cowling: "The proportional dose for any age under adult life is represented by the number of the following birthday divided by twenty-four;" for one year $\frac{2}{24} = \frac{1}{12}$; for three years, $\frac{4}{24} = \frac{1}{6}$; for eleven years, $\frac{12}{24} = \frac{1}{2}$.

SEX, TEMPERAMENT, AND IDIOSYNCRASY, all modify the effects of medicines. Women require somewhat smaller doses than men; and during menstruation, pregnancy, and lactation, all active treatment which is not imperatively demanded should be avoided. To persons of a sanguine temperament, stimulants are to be administered with caution, while, in cases of the nervous temperament, the same care is to be observed in the employment of evacuants. Mercurials are called for where the bilious temperament exists, but, on the other hand, they are generally injurious where the lymphatic temperament is strongly marked. Idiosyncrasy renders many individuals peculiarly susceptible or insusceptible to the action of particular medicines, as mercury, opium, etc.

In DISEASE, an extraordinary tolerance of the action of many medicines is established. In tetanus, immense quantities of opium are borne and required; in typhoid fever, alcohol is freely administered without inducing intoxication; in pneumonia, tartar emetic may be taken in large doses without nausea.

The TIME OF ADMINISTRATION modifies the action of medicines. Where a rapid effect is desired, they are to be given on an empty stomach; on the other hand, irritant substances, as the arsenical or iodic preparations, are best borne when the stomach is full; and the insoluble chalybeates, requiring the gastric fluid to dissolve them, should be taken with the food. To counteract the collapse of low fevers, stimulants, in the *early morning hours*, are called for.

The CONDITION OF THE STOMACH is to be considered in prescribing medicines. In the black vomit of yellow fever absorption cannot take place by the stomach, and in the second stage of cholera endosmosis by the bowels is impossible; here the hypodermic medication is invaluable.

HABIT diminishes the influence of many medicines, especially narcotics.

The influence of RACE, CLIMATE, OCCUPATION, and the IMAGINATION, upon the effects of medicines is often decided, and deserves attention in prescribing.

PARTS TO WHICH MEDICINES ARE APPLIED.

Medicines are applied to the SKIN, to MUCOUS MEMBRANES, to SEROUS MEMBRANES, to WOUNDS, ULCERS, CYSTS, and ABSCESSES, and they are INJECTED INTO THE VEINS.

1. **To the Skin.**—Medicines are applied to the skin for both a local and a general effect; when brought into contact with the skin without friction it is termed the *enepidermic method.* As their influence on *distant* organs is the result of their absorption, this function must be taken into consideration. Solutions of medicinal substances in water permeate slowly through the skin to enter the vessels. M. Hebert first drew attention to the fact that the oily secretion of the sebaceous follicles of the skin prevented the contact of aqueous liquids with the cuticle, though the cuticle itself is the main impediment to absorption. Waller* found that chloroformic solutions of the alkaloids placed in contact with the skin readily produced their effects upon the system. He ascertained that chloroform readily osmoses through the skin, carrying with it dissolved substances, and that the rationale of the process was not due to a solvent action on sebaceous matter.

The application of medicines to the skin by *friction*, *the epidermic method*, is occasionally resorted to, but its results are slow and uncertain. When we wish to affect the system through the agency of the skin, the preferable method is to apply the medicine to the dermis denuded of the cuticle. This is termed the *endermic method*, and the cuticle is usually removed by means of a blister. The medicine is applied to the denuded dermis in the form of powder, or, if very irritating, it may be incorporated with gelatin, lard, or cerate. This method is useful in cases of irritability of the stomach, of inability to swallow, or where we desire to influence the system rapidly and by every possible avenue, or where it is of importance to apply the medicine near the seat of the disease. The dose is to be two or three times the amount which is administered by the stomach. Inunctions of oil, when the digestive apparatus is unequal to its absorption, are sometimes of service in *asthenic conditions*. The skin should be washed with soap and water first.

Another means of applying medicines through the skin is by injection into the subcutaneous cellular tissue, and is termed the *hypodermic* method. Medicines are injected hypodermically for both a *local* and a *general* effect. A constitutional impression can be produced by this means more certainly, rapidly, and efficiently than by the introduction of medicines into the stomach. It is particularly adapted to the speedy relief of pain, to the treatment of diseases in which it is desirable to influence the system with the greatest possible rapidity and effect, and also to cases where the internal administration of medicines is interfered with. The substances proper for hypodermic injection are those which are small in bulk and are of perfect solubility, such as the alkaloids. Substances of imperfect solubility should not be injected hypodermically, dangerous results having followed therefrom, as from the use of some of the salts of quinine. The dose, particularly in first injections, should be two-thirds of the ordinary dose by the stomach, and for females about one-half.

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* *The Practitioner*, London, 1869. vol. iii, p. 330.

The instrument used for injection is a small syringe armed with a sharp tubular needle, and, for the better regulation of the dose, it is desirable that the syringe should be graduated. It is important to avoid the puncture of a vein, lest a suddenly overwhelming effect be produced; and, with this view, the syringe-needle should not be pushed too deply into the tissues, and should be withdrawn a little to allow a wound of a vein to close from elasticity. When a constitutional effect only is aimed at, non-sensitive, vascular parts should be selected, in order to facilitate absorption and give little pain, such as the waist; another good spot for injection is at the insertion of the deltoid muscle, or into the radial border of the forearm, and, where repeated operations are practiced, it is well to vary the point of injection. Irritating injections are best tolerated in the back. To preserve hypodermic solutions from the destructive action of a low order of vegetation (algæ), cherry laurel-water or a weak borax solution should be used.

2. To Mucous Membranes.—Medicines are applied to all the gastro-pulmonary and genito-urinary mucous surfaces.

a. To the *conjunctiva* they are applied for local effects only, and are termed *collyria*, or eye-washes. As a rule their strength should be weak when first used.

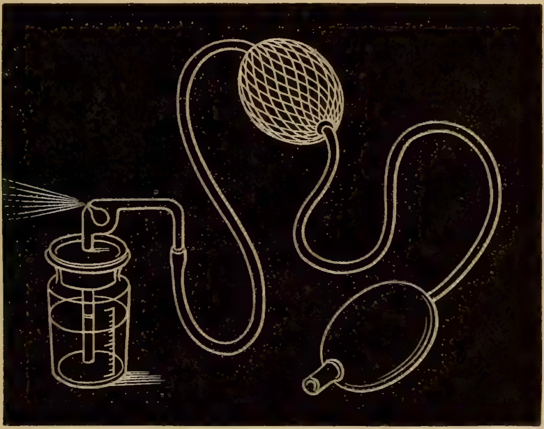
b. To the *nasal* or *pituitary membrane*, they are applied usually for local purposes; sometimes, however, to irritate and excite a discharge, when they are termed *errhines*, now rarely used; sometimes, also, to produce sneezing, with a view to the expulsion of foreign bodies from the nasal cavities, when they are termed *sternutatories*.

c. To the *mucous membrane of the mouth and throat,* medicines are applied almost exclusively for local purposes. When in solution, they are termed *gargarismata* or *gargles.* Powders are introduced by insufflation, as by a scoop-insufflator. In the same way they are blown into the external auditory canal in the treatment of otorrhœa, otitis, etc.

d. To the *Eustachian tubes,* liquids are applied in local affections.

e. On the *aërial* or *tracheo-bronchial membrane,* medicines produce a very decided influence, both local and general. Liquid substances are introduced into the air passages by means of a sponge or syringe, in the treatment of chronic inflammations of the larynx. This kind of instrumentation should be preceded by spraying the part with cocaine. Various substances are inhaled with advantage in phthisis, chronic bronchitis and laryngitis, asthma, etc., while the most powerful effects are produced on the system by the absorption of ethereal vapors and gases through the pulmonary surface.

FIG. 2.



THE HAND-BALL ATOMIZER.

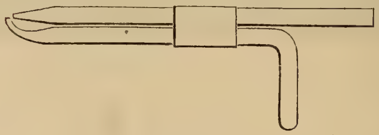
Within the last few years, liquids have been introduced into the air-passages for the treatment of diseases of the respiratory organs, in the form of a *fine spray.* This mode of application, termed the *atomization* of fluids, has proved very valuable, particularly in the relief of throat affections. Various instruments have been resorted to in the atomization of liquids. The *hand-ball atomizer,* which is usually employed, consists of two glass-tubes, with capillary openings, placed at right angles to each other, the vertical tube being dipped in a bottle containing the fluid to be atomized, while at the other end it is close and about opposite to the centre of a capillary opening in the horizontal tube. This connects with an elastic tube, intercepted by two elastic balls, one in the middle, the other, which is furnished with valves, at the end of the tube. The upper ball acts as a reservoir, into which a current of air is forced from the lower ball by pressure with the hand. The air in the vertical glass tube being rarefied, the liquid rises to the capillary opening, and is there pulverized by the current of air from the horizontal tube. In Snowden's atomizer there is but one tube through which the fluid is forced and broken into a fine spray at the tip. To Sajous' pharyngeal atomizer there is a tongue-depressor attached, so that the patient can use it without assistance.

Irritating substances should be guardedly applied to the upper air-passages, particularly the larynx, and before active treatment is instituted the membrane should be cleansed, for which purpose there is nothing better than to spray the parts with Dobell's solution.*

Other medicaments well adapted to atomization are zinc sulphate gr. iij–v to aq. f℥j; tannin gr. v; borax; boracic acid; silver nitrate; potassium permanganate, etc. The *atomizer* is used also to produce local anæsthesia, and as a deodorizer.

As modified by Sass, by means of differently shaped tubes, the spray can be readily generated within various parts of the body, as

FIG. 3.



SASS' SPRAY TUBES.

the back of the throat, nostrils, meatus of the ear, etc. Instead of air, steam has been substituted as the forcing power in the apparatus

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* ℞	Acidi carbolici liquidi,		♏xxx
	Sodii biboratis,		
	Sodii bicarbonatis,	āā	ʒj
	Glycerini,		f ʒ iiss
	Aquæ,	ad	f ℥iv. M.

SIG.—To be used in atomizer. An excellent cleansing spray in *acute* and *chronic nasal catarrh;* also as a mouth-wash in *fetor of breath.*

known as Siégle's. In this instrument inhalation can be practiced without fatigue or assistance, and the warmth of the spray is also an advantage in many diseases of the respiratory organs. The volatile oils, camphor, and potassium chlorate are suitable for steam atomization.

f. The *gastro-intestinal mucous membrane*, of all parts of the body, is most employed for the exhibition of medicines. The stomach, from its great vascularity, its solvent secretions, and the numerous relations which it has with almost every part of the body, is the chief recipient of medicinal agents. The rectum is, however, also frequently employed for various purposes, as to relieve disease of this or of neighboring organs, to occasion revulsion, to produce alvine evacuations, to destroy ascarides, and when, for any reason, it is desirable to spare the stomach.

It is usually recommended that the dose of medicines introduced into the rectum for constitutional effects should be two or three times greater than when taken into the stomach. In the case of active, soluble medicines, however, especially narcotics, it is most prudent to give the same amount by the rectum as by the mouth.

Solid substances introduced into the rectum are termed *suppositories*. Liquids introduced into the rectum are termed *clysters*, *lavements*, *injections*, and *enemata*. (See enemeta). Soluble substances, when thus applied, are usually dissolved in water; insoluble substances, are suspended in some mucilaginous vehicle. When the enema is to be retained, it should not exceed f℥iij in quantity. When it is introduced to act upon the bowels, its bulk may be from f℥xij–xvj for an adult, f℥vj–viij for a youth of twelve, fʒiij–iv for a child of one to five years, and f℥j for a newly born infant. Various syringes are used for the administration of enemata, Higginson's being among the best. Gaseous matters have also been thrown into the rectum, tobacco smoke, for example, to relieve obstruction of the bowels. As the rectum is not a digestive tube, when food is to be introduced by this channel, the essentials for the carrying on artificially of this process must be added; viz., to beef-tea f℥iv add hydrochloric acid ♏x, and glycerole of pepsin fʒij; defibrinated blood, too, as a restorative agent, has been injected into the rectum after uterine hemorrhage, with success (Leon).*

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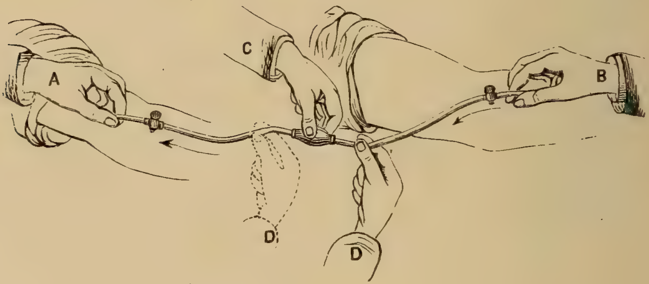
* Valor Terapeutico de Los Enemas de Sangre Deofibrinata; *Gaz. Med. Cat.*, 1886, IX, 711.

To the *urino-genital* and *vagino-uterine membranes,* applications are made exclusively for local purposes. Within a few years intra-uterine medication has been a good deal employed in local affections of the uterus, but in the injection of fluids into the uterus there is danger of metro-peritonitis.

3. **To Serous Membranes.**—Irritating solutions are injected into the cavity of the tunica vaginalis testis, in hydrocele; into the hernial sac, in hernia; and even into the pleural cavity, in pleurisy, for the purpose of producing adhesion of the sides of the sacs.

4. **To Ulcers, Wounds, and Abscesses,** medicines are applied chiefly for their local effects. The absorbing power of these surfaces is to be kept in mind in such applications. *Cysts* are sometimes cured by injections, as of tincture of iodine into cysts of the thyroid gland.

FIG. 4.



5. **The Injection of Medicines into the Veins** has been occasionally practiced. The operation is, however, objectionable, from the danger of introducing air into the circulation; and it is seldom resorted to, except in the case of *transfusion of blood* after uterine or other hemorrhage, or exhausting disease.

Transfusion will often be found an efficient remedy, although there is always risk of coagulation of the blood in the veins. The more direct and immediate the transfusion, the safer the operation, as by Aveling's apparatus, which consists of an India-rubber bulb, oblong in shape, and of sufficient size to contain two fluidrachms; India-rubber tubes six or seven inches in length attached to the extremities of the bulb; and stop-cocks attached to the outer extremities of the tubes. Also, two silver-tubes; one, bevel-pointed, called the afferent tube (seen at A), which is to be inserted into the vein in the arm of the patient; the other, round-pointed, called the efferent tube (seen at B), which is to be inserted into the vein in the arm of the donor, also a pair of fine forceps and a scalpel.*

THE CLASSIFICATION OF MEDICINES.

In treating the articles of the Materia Medica some writers have classified them according to their natural properties, others according to their action on the human system. To the student of medicine a classification based upon the sensible qualities or natural affinities of medicines can be of little value, since it associates articles of the most opposite remedial properties. A classification of medicines founded on a similarity of action on the animal economy is more desirable and useful, and various arrangements of the Materia Medica have been attempted on this basis. They are all, to some extent, necessarily imperfect, owing partly to the diversified effects of medicines and partly to our ignorance of the real nature of many of the modifications which they produce upon the tissues. Still, the advantages of some arrangement of this kind are so numerous that it cannot well be dispensed with.

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* The mode of operation is as follows:—

First, place the apparatus in a basin of tepid water, and while completely under the water, for the purpose of filling it and insuring its cleanliness, compress and expand the bulb until the air contained within the bulb and rubber-tubing is completely expelled. When the air has been completely expelled, and while the apparatus is yet remaining beneath the surface of the water, turn the stop-cocks at both extremities of the rubber-tubing in such a manner as to entirely preclude the possibility of air gaining access to its cavity. The patient having been brought to the side of the bed and the arm made bare, a fold of skin over a vein at the bend of the arm is to be raised, transfixed and divided. The vein now brought into view is to be seized with the fine forceps, slightly raised, and a small opening made into it for the reception of the bevel-pointed silver or afferent tube. This tube, which has been lying in the basin of tepid water, should carefully be kept filled with water when it is removed, by placing the thumb or finger over its larger opening.

The tube now being filled with water, has its bevel-pointed extremity at once inserted into the opening already made in the vein, and is then entrusted to the care of an assistant (A), who carefully compresses the edges of the wound around the tube, and at the same time holds his thumb or finger over its larger opening to prevent the escape of the water.

While the operator is performing this part of the operation, an assistant should prepare the arm of the blood-donor in the same manner as for venesection. An opening is then made into the vein, and the round-pointed or efferent tube at once inserted with its point toward the fingers. The donor should then be seated in a chair at the bedside of the patient. It is better not to secure the tubes in the veins by ligatures. B represents the hand of an assistant holding the efferent tube carefully compressed within the lips of the wound, in the same manner as with the afferent tube at A.

The India-rubber portion of the apparatus, thoroughly cleansed, air perfectly expelled and completely filled with water, is now to be carefully and closely adjusted to the two tubes in the veins. When adjusted the stop-cocks are turned straight, and transfusion is commenced by first compressing the India-rubber tube on the efferent side (donor's), and then squeezing the bulb, which forces two drachms of water into the efferent vein. Next, while the bulb is compressed, shift the hand and compress the India-rubber tube upon the afferent (patient's) side. Then allow the bulb to expand slowly, and blood will be drawn into it from the donor's vein. When the tubing and bulbs are filled bring the hand back, compress the tube, follow this by compression of the bulb, and two drachms of blood will be thrown into the afferent vein. In this manner the process can be repeated any number of times desired, rapidly or slowly, and the exact amount of blood transfused can be known by counting the number of times the bulb has been emptied, one being subtracted, which accounts for water first used.

The following classification will be found to include the more ordinary and generally received divisions of the Materia Medica, and to present the articles in convenient groups for therapeutic application.

Medicines may be divided into—

I. Those which have a special action on the nervous system, or *Neurotics* (from νεῦρον, a nerve).	Narcotics, Anæsthetics, Antispasmodics, Tonics, Astringents, Stimulants, Sedatives, Spinants.
II. Those which have a special action on the secretions, or *Eccritics* (from 'ἐκκρῖσις, secretion).	Emetics, Cathartics, Diaphoretics, Diuretics, Blennorrhetics, Emmenagogues.
III. Those which modify the blood, or *Hematics* (from αἷμα, the blood).	Hematinics, Alteratives, Antacids.
IV. Those which act topically.	Antiseptics, Irritants, Demulcents, Coloring Agents, Anthelmintics.

CLASS I.—NEUROTICS.

ORDER I.—NARCOTICS.

Narcotics (from ναρκόω, to *stupefy*) are medicines which impair or destroy nervous action. The primary effect of narcotics is, however, of a stimulant character, and their therapeutic efficacy is in a great degree due to this action. They are often administered, too, for a true narcotic or sedative influence on the motor, sensory and intellectual functions. In diseased conditions, a marked tolerance of this class of medicines is established, and they can be exhibited in large doses without inducing narcosis. They are employed, chiefly, to remove muscular spasm, relieve pain, allay cerebral or spinal irritability, and procure sleep.

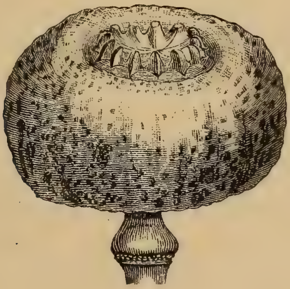
When employed to relieve pain, they are termed *anodynes;* when employed to procure sleep *hypnotics* or *soporifics.*

When this class of medicines is resorted to for any length of time, with a view to a *narcotic* effect, their influence upon the system is much diminished, and constantly increased amounts are called for to maintain the same effect.

OPIUM.

Opium (from ὀπός, *juice*) is the CONCRETE MILKY EXUDATION of the unripe capsules of Papaver somniferum (*Nat. Ord.* Papaveraceæ).

FIG. 5.



POPPY-CAPSULE.

The opium-poppy is a native of Persia, but is cultivated in various parts of Asia, in Europe, and in the United States. It is an annual plant, with a round, leafy stem, from two to four feet or more in height, and large four-petaled flowers. There are two prominent varieties of this species: the *black* poppy, with violet colored or red flowers, brown or blackish seeds, and globular capsules; and the *white* poppy, with white flowers and seeds, and ovate capsules; but these varieties run into each other under cultivation.

The NEARLY RIPE CAPSULES (PAPAVER) are from an inch and a half to two inches or more in diameter, and contain a good deal of opium. They are sometimes given to children in the form of *syrup,* and are applied externally as an anodyne emollient, in the form of *decoction.* The seeds are destitute of narcotic properties, and are used in Europe as an article of diet, and for the manufacture of an oil.

Opium is obtained from incisions in the half-ripe capsules. The juice which exudes from the incisions is allowed to evaporate spontaneously, and is scraped off after drying, generally with more or less of the epidermis, and is sometimes sent into the market unmixed, as a choice variety. The opium of commerce is, however, commonly made by adding the dried juice, obtained by incision, to an extract prepared by expression, or even from a decoction of the leaves, the whole being kneaded together, formed into cakes, and wrapped in fresh poppy-leaves.

The commerce of the United States is supplied with opium almost exclusively from Asiatic Turkey. This is known in the market as *Smyrna* or *Turkey* opium, and comes in irregularly rounded or flattened cakes, covered with the capsules of a species of Rumex.

A large amount of opium is produced in British India, for consumption in India and China, but it is not found in our markets. The Persian opium is another variety, as is that obtained from upper Egypt, but these do not reach the United States.

The best opium should have a fine chestnut color, an aromatic, strong, peculiar smell and a dense consistence—becoming, however, harder and darker by being kept. It should be moderately ductile, break with a deeply-notched fracture, and, when drawn across white paper, should leave an interrupted stain. The taste is very bitter and somewhat acrid, and when chewed it excites irritation in the mouth and throat. It is inflammable, and imparts its virtues to water, alcohol and diluted acids, but not to ether.

CHEMICAL CONSTITUENTS AND TESTS.—Opium contains a great variety of chemical constituents, the most important of which is the alkaloid MORPHINA (*morphine*). Other principles found in opium are the alkaloids, *narcotine*, *codeine*, *narceine*, paramorphine (thebaine), papaverine, pseudomorphine (phormine); meconin, meconic and thebolactic acids, gum, extractive, resin, oil, etc., but no tannin or starch, and, in very minute amounts, alkaloids, termed meconidine, laudamine, codamine, lanthopine, rhœadine, laudanosine, protopine, hydrocotarnine, deuteropine, oxynarcotine, gnoscopine, and cryptopine. Porphyroxin, so called by Merck, is not a proximate principle, but a complex substance, consisting of several alkaloids (Hesse). Morphine is the principle upon which the narcotic effects of opium essentially depend, and, with its salts, is official in all the pharmacopœias.

Morphine exists in opium chiefly in combination with meconic acid. The morphine meconate is separated from the other constituents of the drug by successive macerations with water. Alcohol and water of ammonia are then added to the aqueous solution, by which the salt is decomposed, the ammonia precipitating the morphine and the alcohol seizing the coloring matter as soon as it is separated from the alkali. The crystals of morphine which are formed are afterwards boiled in alcohol, and the solution is filtered through animal charcoal. Good samples of opium, when dried, should yield *not less than* 12 *nor more than* 16 per cent. of morphine.

Morphina (*Morphine*) ($C_{17}H_{19}NO_3.H_2O$) occurs in colorless, rhombic, prismatic crystals, without smell, but of very bitter taste. It is very slightly soluble in water and ether, nearly insoluble in chloroform, partially soluble in cold and more nearly soluble in boiling alcohol. Acetic ether (ethyl acetate) is the best solvent for it. From the insolubility of the alkaloid the *salts* of morphine are preferred for medicinal use; they are freely soluble in water and diluted alcohol, but are insoluble in ether and chloroform. *Tests:* 1. *Concentrated nitric acid* strikes with morphine and its salts a rich orange-red color, slowly fading to yellow; this will detect gr. $\frac{1}{10000}$ in the dry state (Wormley). 2. Neutral solutions of *ferric chloride* or *sulphate* color them deep blue. Other tests are recommended, but these are the best.

Narcotine ($C_{22}H_{23}NO_7$) exists in opium, chiefly in the free state, and, being insoluble in water, is left behind when the drug is macerated in this menstruum. It occurs in white, tasteless, inodorous, needle-like crystals, which are soluble in ether, alcohol, and still more so in chloroform. At one time it was thought to possess a portion of the narcotic properties of opium, but it is now admitted to be inert in this respect. Its salts, which are bitter, have been used in India as stomachics, and as febrifuge tonics in the treatment of intermittent fever.

Codeina (*Codeine*) ($C_{18}H_{21}NO_3.H_2O$) exists in opium combined, like morphine, with meconic acid, and is extracted in the process for obtaining the latter alkaloid, from which it may be separated by an alkaline solution, which dissolves the morphine and leaves the codeine. It occurs in colorless, octahedral crystals, of a bitter taste, soluble in water, alcohol, ether and chloroform.

Narceine ($C_{23}H_{29}NO_9$) is obtained from the mother liquid left after crystallizing out the salts of morphine. C. Bernard affirms that it is the most certain hypnotic of all the opium alkaloids. Da Costa's experience shows that it has little effect on skin or pupil, and that its hypnotic action is uncertain or inert, while Eulenberg asserts that to get its hypnotic effects it must be given in doses twice as large as morphine.

Paramorphine (*Thebaine*) ($C_{19}H_{21}NO_3$) is said to be a tetanizing toxic agent, analogous in its effect to strychnine.

Papaverine ($C_{21}H_{21}NO_4$) is said to produce some soporific action, with a sedative influence on the pulse; its strength is from one-eighth to one-fourth of that of morphine.

Cryptopine ($C_{21}H_{23}NO_5$) is thought to produce an hypnotic influence analogous to that of morphine, though a much feebler agent. The statements in regard to the action of the last four alkaloids are conflicting.

Meconic acid is inert, but is interesting as affording the most delicate test for opium; ferric chloride or sulphate produces, with even very diluted solutions of opium, the blood-red color of ferric meconate, which is not discharged by diluted acids or corrosive sublimate.

INCOMPATIBLES.—Alkalies, and astringent infusions containing tannic acid, are incompatible with opium; the former precipitate morphine from its soluble combination, while the latter form with it an insoluble compound. Iodine and the iodides, bromine and the bromides (after standing) produce preciptates with the morphia salts, an iodide or bromide of the alkaloid being formed. A few drops of dilute HCl acid added to the bromide mixture will effect solution. Sodium biborate throws down a precipitate with the salts of morphia, cleared up by boric acid. Many of the mineral salts are also decomposed by opium, as lead acetate (lead meconate and morphine acetate being formed). This chemical incompatibility, however, does not interfere with the physiological action of opium; for instance, lead acetate and laudanum, though incompatible, produce a local sedative effect; moreover, lead acetate, opium or the morphine salts may be safely prescribed together in pill form.

AIDS.—Its hypnotic action is aided by the bromides, chloral, urethan, paraldehyd and hypnone; its analgesic, by belladonna and cocaine, but it should not be prescribed in full doses with these agents.

CONTRAINDICATIONS.—It is positively contraindicated only where there is a tendency to apoplexy or coma, where the opium habit exists, where asphyxia is threatened by copious secretions in the air passages, or where there exists an idiosyncrasy with respect to its effects.

Physiological Effects.—Opium exerts a marked therapeutic action in the relief of pain, spasm, wakefulness, nervous irritability, and certain forms of morbid discharge, especially from the alimentary canal, by a primary stimulant action, antecedent to any narcotic influence. In such conditions a tolerance of its effects is established, and very large amounts may be taken without inducing narcosis. Opium applied *locally* deadens the sensibility of the nerves of a part without influencing the brain (*Trousseau et Pidoux*, vol. ii). In detail its physiological action in *moderate doses* is as follows: Nervous system: the cerebral functions are stimulated, accompanied by an agreeable exhilaration of the intellectual faculties, followed by drowsiness, consciousness being finally lost in sleep, the latter sometimes disturbed by dreams. Such sequelæ as headache, nausea and constipation are common. The reflex function of the spinal cord is diminished, and in lethal doses destroyed, death taking place from paralysis of the respiratory centre. Pupil: in full doses opium contracts the pupil; but, since the local application of morphine scarcely possesses this power, it follows that its action must be systemic, due probably to stimulation of the oculo-motor centres. Circulation: the heart's action becomes slower and fuller, from a depressing influence on the cardiac motor ganglia; at the same time the arterial tension is raised. Respiration: this becomes slower, and the bronchial mucus is lessened. Secretions: the intestinal secretions are diminished, and, as peristaltic action is retarded, constipation results; the urine is slightly diminished, as is also the saliva; in one word, all the secretions are lessened except that of the skin, which is increased. According to Phillips the drug is partly eliminated by the skin. In regard to its elimination by the kidneys, Eliasson's * conclusions are as follows, viz., that large doses only can be found in the urine, small being undetectable, though there appears with the latter in the urine a supposed morphia-derivative. In some persons an itching and miliary eruption of the skin occurs. Most of the opium alkaloids increase the excretion of urea.

To sum up, opium, in man, expends its force chiefly on the higher cerebral centres, scarcely influencing the cord at all, unless in full doses, while in the lower animals whose cerebra are undeveloped, as the frog, it acts wholly on the cord, and in them, in the absence of a well-developed brain, hypnotism is unusual. According to Fothergill, opium produces sleep by causing cerebral anemia and diminished activity of the cells; and is analgesic by lessening the conductivity of nerve-matter.

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* Beiträge zur Lehre von dem Schicksal des Morphins im Lebenden Organismus. Inaug. Dissertation, Königsberg, 1882, von W. Eliasson.

TOXICOLOGY.—When a poisonous dose is taken, the stage of excitement is wanting; giddiness and stupor rapidly come on, with diminution in the frequency, though not in the fullness, of the pulse; and these symptoms are soon followed by an irresistible tendency to sleep, and finally by coma. The breathing is heavy and stertorous, the pulse slow and oppressed, and the *pupils are contracted.* If relief be not afforded, the pulse sinks, the muscular system becomes relaxed, and death ensues, preceded sometimes in children by violent convulsions. In adults even gr. ¼ of morphine,* hypodermically, and gr. ivss. of opium,† have caused death, but such results are rare. On the other hand, enormous amounts (laudanum‡ f℥vij, and in the case of a girl aged 11½,§ f℥xij) have been taken without fatal consequences.

ANTIDOTES.—*In cases of poisoning from opium* or its preparations, the stomach should be immediately evacuated by the stomach pump, if possible, or by emetics. Owing to the torpor of the stomach, emetics are to be given in double the ordinary doses, and the direct emetics are to be preferred, as zinc sulphate (gr. xx-xxx) or copper sulphate (gr. v–x), in a tumbler of water. A large tablespoonful of mustard flour, or of powdered alum, answers very well as an emetic, or apomorphine hydrochlorate (gr. $\frac{1}{16}$) may be given hypodermically. Every means should be taken to arouse the patient from his lethargy; he should be kept awake, and made to walk as long as possible; afterward cold affusions, counter-irritation to the nape of the neck and extremities, flagellation to the palms of the hands and soles of the feet, and, best of all when the coma is profound, the *electro-magnetic battery* should be resorted to, one electrode to be placed above the origin of the phrenic nerves, the other over the epigastrium. Artificial respiration is also to be practiced. The use of strong coffee has proved efficacious; and stimuli may be given to support the system. It has been found that atropine exercises a powerful influence as a physiological antidote to opium, *these drugs acting in an opposite manner on respiration, brain, skin, pupil and circulation.* A hypodermic injection of atropine sulphate, gr. $\frac{1}{40}$ to $\frac{1}{60}$, should be administered when there is any sign of the failure of respiration, and repeated in fifteen to thirty minutes, the frequency and dose depending on the condition of the *respiration*, not of the pupil or depth of coma. The poisonous action of opium appears to be entirely directed to the nervous system, since no local lesions are found after death.

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* *Chicago Med. Exam.*, May, 1878, p. 493.

† A Treatise on Poisons, 4th ed., p. 713, by Christison.

‡ *Med.-Chir. Trans.*, Vol. I, p. 77.

§ *Guy's Hosp. Reports*, XI, 1865, p. 287.

Opium is largely used as an habitual narcotic in Oriental countries, and to some extent in Europe and the United States. The effects of indulgence in this species of intoxication are of the most destructive character upon both the physical and mental faculties. A confirmed opium smoker can be recognized, generally, by his pallor, emaciation, and contracted pupil.

In China extensive establishments are devoted to the smoking of opium, a form of dissipation that has fewer evils following in its train than those caused by the abuse of alcohol; in fact, the "pipe" puts the smoker to sleep, and so effectually prevents the crimes so often induced by alcoholic inebriation. It is quite possible to indulge in the "pipe" and yet enjoy good health. In fact, there are many Chinamen who, smoking in moderation, experience no evil effects therefrom. In Japan opium smoking is unknown, as the importation of the drug is rigorously prevented by law. As opium is either taken by means of the pipe, hypodermic injection, or in solution, the expression "opium eating" is a misnomer.

MEDICINAL USES.—Of all the articles of the Materia Medica, opium enjoys the widest range of therapeutic application. From its properties of assuaging pain and inducing sleep it is useful in almost all diseases, and should be given in doses sufficiently large to produce a *decided effect.* As an *anodyne* in all injuries, as *sprains*, railway accidents, *burns*, etc , to relieve *pain* and resist surgical *shock*, we have no substitute for opium; and as an *hypnotic* in *delirium tremens* and in the *insomnia* and cerebral irritability of *fever*, *mania*, *mania à potu*, *hydrophobia* and *tetanus*, either opium or morphine, the latter hypodermically, are equally invaluable. Prior to an operation, to avert surgical shock, gr. ¼–⅓ of morphine may be thrown under the skin before etherization. In delirium tremens, when the arterial tension is high, to enhance its hypnotic effect, it is well combined with sedatives, as the bromides, chloral or aconite, as in the following:—℞ Morphinæ sulphatis, gr. ¼–⅓; chloral, gr. xv; syrupûs tolutani, fʒss; aquæ, ad f℥ss, p. r. n.

From its power of relaxing muscular *spasm* it is our most efficient resource in *colic*, either *biliary*, *renal*, *intestinal* or *uterine*, being preferably given hypodermically, and often with atropine.

In *acute dysentery*, *cholera* and *cholera morbus*, opium forms the basis of every variety of treatment, partly for its diaphoretic effects, but principally for its action in arresting the intestinal secretions and peristalsis. In the collapse of cholera, Dr. Gallagher has derived great benefit from morphine subcutaneously. In dysentery, extract of opium gr. ss is given every two hours, continued until an impression is made, or it becomes contraindicated; or laudanum may be combined in the first stage with castor oil or Rochelle Salt (see Sal Rochelle); again, opium is often added to astringents, vegetable or mineral, and lastly, it may be introduced within the rectum, either in starch-water or suppository, as a curative measure, or for the relief of tenesmus. In conjunction with the above treatment, the patient should be placed upon a stimulating fluid diet, as milk and brandy. In some cases of dysentery it has been found that opium causes retention of the dejecta, which, by fermenting, irritate the bowel, hence it may at times do harm.* In *acute diarrhœa*, preferably after the exhibition of a cathartic, opium is indicated with a vegetable astringent:—℞ Tincturæ opii deodoratæ, ♏x; tincturæ kino vel catechu, fʒj–ij; aquæ cinnamomi, f℥ss. M. Sig.—Every three or four hours; or if accompanied with flatulency—℞ Extracti opii, gr. ¼; pulveris camphoræ, gr. iij; oleoresini capsici, gr. ¼; M. Ft. pil. No. 1. Sig.—Every three hours.

In that form of diarrhea where the motions quickly follow after eating it is particularly serviceable by restraining peristalsis, thus allowing time for digestion. In *peritonitis*, in which large amounts are well borne, morphine hypodermically should be administered from the first, and the patient later kept narcotized by opium itself; while in *puerperal septicemia* it has been found more successful than any other remedy. In gastric irritability, to check vomiting, in *colica pictonum*, to relieve the pain of *rheumatism* and *gout*, opium or morphine are constantly employed, and hypodermics of morphine in *myalgia*, *lumbago*, *torticollis*, and the various neuralgiæ are the best means of alleviating the pain, and not infrequently effect a cure. In *meningitis*, *cerebral* and *spinal*, it is of the greatest value, no other drug being comparable to opium, of which gr. ss–ij may be given hourly, so as to keep the patient thoroughly under its influence. In other convulsive diseases, such as *uremic convulsions* (Loomis) and *puerperal eclampsia*, it is an efficient remedy; moreover, an approaching paroxysm of *malarial fever*, pernicious or intermittent, may be prevented, if necessary, by the timely injection of morphine.

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* See the Med. and Surg. Hist. of Rebellion, chap. on Dysentery.

To check peristalsis and relieve pain opium or morphia are our most reliable agents in *enteritis* and *typhlitis*. In *intestinal hemorrhage* they place the bowel in splints as it were and thus ensure that quietude which is so needful for repair, while in *intussusception*, as an aid to surgical measure, full doses of either, well combined with belladonna, are indicated to allay the pain and quiet the spasm. In the relief of *after pains* morphia or atropia are the best anodynes, care being taken to free the uterus of clots with ergot at the time of their administration.

For the relief of the cough of pulmonary affections, as *acute bronchitis*, opium and morphia have no equal in the Materia Medica, but are generally contraindicated before the secretions are established, except in minute doses combined with a diaphoretic, as in Dover's powder. Good formulæ are: ℞ Morphinæ sulphatis, gr. ij; syrupûs ipecacuanhæ f℥ijss; syrupûs pruni virginianæ, f℥iij; aquæ ad f℥vj. M. et Sig.—tablespoonful every three hours. ℞ Tincturæ opii camphoratæ, glycerini, et syrupûs pruni virginianæ āā f℥j. M. et Sig.—A teaspoonful, repeated as necessary.

In the first stage of *pleurisy*, morphine hypodermically, together with aconite and a large dose of quinine per orem, and perhaps a blister, is the best means of relieving the pain and cough and hindering effusion.

Morphine subcutaneously will generally relieve a paroxysm of *asthma* and *angina pectoris*, although without curative power, and Dr. Allbutt recommends it to alleviate *cardiac dyspnœa*, which statement the editor can confirm. Thus given it is the best remedy for nocturnal *chordee*.

In *sunstroke*, too, good results have been obtained from morphine injections with antipyretic and sedative treatment (Dr. Jas. Hutchinson). Opium, and recently its alkaloid codeine, have been highly lauded in the treatment of *diabetes mellitus;* and, lastly, in *gangrene* its use is indicated.

Caution must be enjoined in prescribing opium in chronic diseases for fear of originating the opium-habit, which may be contracted where there is much suffering, on account of the speedy relief afforded by it.

Topically, it is used in the form of ointment to relieve the pain of *boils, abscess, carbuncles* and *hemorrhoids*, either alone or with belladonna: ℞ Extracti opii, extracti belladonnæ āā gr. xxj; acidi tannici gr. x; adipis ℥ss. M. et Sig.—Apply to piles. In suppository, it is serviceable both for its local and constitutional effects, in *strangury, acute cystitis, anal fissure, proctitis, prostatitis*, uterine disorders, as *abortion*, and to control *chordee:* ℞ Extracti opii, gr. j; extracti belladonnæ gr. ss. M. ft. supposit. no. I. As a sedative collyrium, in aqueous solution, with lead-water, as an anodyne lotion, or as an addition to poultices, it is daily employed.

ADMINISTRATION.—The ordinary dose of opium as an anodyne and hypnotic is gr. ss–ij. Much larger doses are, however, called for in many diseases; and when it is administered for a length of time, as a narcotic, the dose must be gradually increased. To infants and very old persons it is to be given with great caution. Some of its disagreeable effects may be obviated by the addition of other remedies; thus, if it constipate, by combining it with aloes, or if there be anorexia, with capsicum.

The following are the official preparations of opium:—

Opii Pulvis (*Opium Powder*). Used in making most of the opium preparations. It should contain *not less than* 12 *nor more than* 16 *per cent. of morphine.* This, as Dr. Squibb has pointed out, causes a great variation in their strength, depending on the percentage of morphine in the powdered opium; thus laudanum f℥j may contain from gr. 5.44 to gr. 7.25 of morphine.

Opium Denarcotizatum (*Denarcotized Opium*) Opium freed from narcotine, etc., by means of ether, and containing 14 per cent. of morphine. Dose, gr. ss–ij.

Pilulæ Opii (*Pills of Opium*). Each pill contains gr. j.

Extractum Opii (*Extract of Opium*). Dose, gr. $\frac{1}{2}$.

Trochisci Glycyrrhizæ et Opii (*Troches of Glycyrrhiza and Opium*). *Wistar's cough lozenges;* are very useful to allay irritative laryngeal or pharyngeal *cough* and *hoarseness.* Each troche contains gr. $\frac{1}{20}$ of extract of opium.

Emplastrum Opii (*Opium Plaster*). Made by mixing extract of opium with Burgundy pitch and lead-plaster. Useful to allay the pain of *boils*.

Pulvis Ipecacuanhæ et Opii. *Powder of Ipecac and Opium. Dover's Powder* is a most valuable anodyne diaphoretic, extensively prescribed in the early stages of *acute diarrhœa, dysentery, rheumatism, bronchitis, pneumonia, acute nasal catarrh,* etc. Dose, gr. x, containing gr. j of opium and ipecac each.

Tinctura Opii (*Tincture of Opium.*) *Laudanum.* Contains 10 per cent. of powdered opium. It should be recollected that the opium from which these preparations are made contains from 2 to 6 per cent. more morphine than that formerly employed. This is the most commonly used of all the official preparations of opium. When long kept, particularly if exposed to the air, it becomes thick from evaporation of the alcohol, and its strength is much increased. Dose, ♏xij, or about 25 drops, equivalent to opium gr. j. There are 120 drops in fʒj. To relieve the pain of *earache* the introduction of hot laudanum and olive-oil within the external auditory canal is a good remedy. Laudanum is much used in the form of enema. (See enemata).

Tinctura Ipecacuanhæ et Opii (*Tincture of Ipecac and Opium*). Dose, ♏x–xx.

Tinctura Opii Camphorata (*Camphorated Tincture of Opium*). *Paregoric Elixir.* Contains opium in diluted alcohol, with benzoic acid, oil of anise, glycerin and camphor. Dose, fʒss, or a tablespoonful, containing rather less than a grain of opium. A favorite preparation for children, and particularly serviceable in *cholera infantum* and *bronchitis*. From 5 to 20 drops may be given to an infant.

Tinctura Opii Deodorata (*Deodorized Tincture of Opium*). In preparing it, the narcotine and odorous ingredients of opium are got rid of. A valuable preparation. Dose, ♏xij.

Acetum Opii (*Vinegar of Opium*). *Black Drop.* Dose, ♏xij.

Vinum Opii (*Wine of Opium*). *Sydenham's Laudanum.* Dose, ♏xij.

Morphinæ Sulphas (*Morphine Sulphate*), **Morphinæ Acetas** (*Morphine Acetate*), **Morphinæ Hydrochloras** (*Morphine Hydrochlorate*), are the official salts of morphine, made by saturating the alkaloid with sulphuric, acetic or hydrochloric acids. The sulphate and hydrochlorate occur in the form of snow-white, feathery crystals, the acetate (which is not very stable) as a white powder. They have a bitter taste, are all freely soluble in water and alcohol, and produce analogous medicinal effects; the sulphate is most employed in this country. The salts of morphine possess the *analgesic* and *hypnotic*, but not the *diaphoretic* properties of opium, and are considered *less* apt to produce *headache*, *nausea* or *constipation*. They are peculiarly adapted to the *hypodermic* and *endermic* methods of application. Dose, gr. $\frac{1}{6}$–$\frac{1}{4}$, equal to opium gr. j. Magendie's solution, not official, used hypodermically, contains gr. xvj to f℥; but for this purpose compressed tablets, or the powder dissolved in water as required, are preferable, and its efficiency is often promoted by the addition of atropine.

Troches of Morphine and Ipecac (Trochisci Morphinæ et Ipecacuanhæ); each troche contains gr. $\frac{1}{40}$ of morphine sulphate and gr. $\frac{1}{12}$ of ipecac.

Pulvis Morphinæ Compositus (*Compound Powder of Morphine*) (*Tully's Powder*). Contains morphine sulphate (1 part), mixed with camphor, liquorice and calcium carbonate (of each 20 parts).

Codeina (*Codeine*) is official, and has been found to possess uncertain narcotic powers, gr. j having failed to be hypnotic, while gr. iv have caused insomnia and slight delirium; * again, gr. v have produced no effect (S. Weir Mitchell). It may be used as an anodyne and hypnotic, and appears to have a sedative effect on the vagus also. It has been used with success in *gastrodynia*, to allay troublesome *cough*, and is said to be of service in *diabetes mellitus*. Dose, gr. ss–ij, in water, with elixir of orange.

LACTUCARIUM.

Lactucarium (*Lettuce Opium*) is the CONCRETE MILK-JUICE of Lactuca virosa, the garden-lettuce (*Nat. Ord.* Compositæ), and is obtained from incisions in the stem of the plant, during the period of inflorescence. Two varieties are found in the market: *English* and *German lactucarium*, the latter being inferior. It occurs in small, brownish lumps, with an opiate smell. The bitter principle, termed *lactucin*, is said to possess less *hypnotic* power than the crude drug.

EFFECTS AND USES.—Lactucarium possesses *very feebly* the *anodyne* and *hypnotic* qualities of opium. It may be given where opium disagrees from idiosyncrasy. Dose, gr. x; of the *syrup* fʒij–iv; of the *fluid extract* fʒj.

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* *British Medical Journal*, 1874, 1, 478.

PARALDEHYD.

This remedy, not official, is a polymeric modification of ethyl aldehyd $(C_2H_4O)_3$, and is formed by treating it with a mineral acid.

It is a colorless liquid, boiling at about 255° F. and solidifying into fusible crystals at 51° F. It has an acrid taste, a volatile odor like that of chloroform, is more soluble in cold than in hot water, and has a sp. gr. of .998.

AIDS.—Morphia, urethan, and hypnone.

PHYSIOLOGICAL EFFECTS.—The action of paraldehyd has been studied by Drs. Cervello,[*] Morselli,[†] Albertoni,[‡] S. A. Popoff,[§] Andruzski,[||] Carl von Noorden,[¶] Berger, Langreuter,[**] Dana and others, all of whom agree that it is *hypnotic* and sedative, lowers reflex activity, and is comparatively free from unpleasant after-effects. *Locally:* it is strongly antiseptic and anti-fermentative. Nervous system: the action of paraldehyd is exerted on the hemispheres, medulla and cord, in the order named (Coudray).[††]

Small doses cause a temporary increase followed by depression of the excitability of the cerebral cortex, and quiet, *tranquil sleep*. When a large dose is taken the primary stimulation is absent. The pupils are unaffected. Paraldehyd depresses and in toxic doses paralyzes the respiratory centre of the medulla. The reflex centres of the cord and the peripheral endings of sensory nerves are depressed, causing a diminution, and, if a toxic dose have been taken, a subsequent loss of sensibility, reflex action, and voluntary motion; the excitability of the motor nerves and of the striated muscles remains unimpaired.

Circulation: even large doses do not affect the circulation nor the arterial tension. If, however, toxic doses be administered the cardiac frequency is at first decreased but soon increased, the individual beats becoming weaker than normal, a gradual fall taking place in the blood-pressure, the heart finally stopping in diastole.

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[*] *Archiv. Ital. de Biologie*, 1884, p. 113. *Archiv. pour le Science Med.*, Vol. VI. *El Pisani*, Disp. IV, V and VI.

[†] *Gazz. degli Ospitali*, Jan., 1883, Nos. IV, V and VI. *Rev. Sper. di Fren. e di Med. Leq.*, 1882. *El Pisani* Fasc., iii, loc. cit.

[‡] *Riv. di Chim. Med. e Farmaceu-tossico e Farmaco.*, Feb. and Mar., 1883.

[||] *Meditz. Obozrenie*, Fasc. I, Vol. XXI, 1884, p. 69.

[§] *Arkhiv. Psykhiatriee, etc.*, Vol. IV, Fasc. I, 1884, p. I.

[¶] *Centralbl. für Klin. Med.*, March 22, 1884.

[**] *Centralbl. für Klin. Med.*, loc. cit. *Berlin. Klin. Wochensch.*, June 16, 1884.

[††] *Thèse de Paris*, 1886.

It is said that the cardiac arrest is only due to cessation of the respiratory act and that it may be prevented by resorting to artificial respiration.

Respiration and temperature: more or less marked slowing of respiration always occurs, and if a sufficiently large dose be taken, there is final respiratory paralysis of central origin. The temperature is slightly lowered.

Alimentary tract: as a rule, no gastro-enteric disturbance occurs on waking; but if the dose be large and the medicine administered for a prolonged period, gastric catarrh and disordered nutrition may result (Andruzski), though most observers have not seen these effects following its prolonged use. Secretion: the urine is increased in amount. Prof. Popoff found that large intravenous injections destroyed the red corpuscles and produced hematuria. Elimination takes place through the kidneys and the lungs, the odor of paraldehyd having been detected in the breath twenty-four hours after its administration.

Medicinal Uses.—Paraldehyd is contraindicated in irritable states of the throat and stomach by reason of its acridity. It is chiefly used as an hypnotic in the *insomnia* of various mental disorders, or in insomnia from prolonged mental work, or where other hypnotics have proved insufficient or are contraindicated. Its good effects are especially conspicuous where insomnia is not due to pain or to mechanical causes, such as dyspnœa or cough. In the insomnia of *acute* or *chronic mania*, *delirium tremens*, *dementia paralytica*, *hysteria*, etc., it is useful by procuring sleep, but otherwise exerts no influence upon the disease.

It has also been used with occasional benefit as an anodyne and hypnotic in *neuralgic affections* (Morselli). From its depressing influence on the reflex functions of the cord it has been given in *epilepsy*, and according to Riggi, is as useful in this affection as potassium bromide.

Cervello found that paraldehyd was a physiological antagonist to strychnine, preventing the toxic symptoms of that alkaloid if given before their appearance or causing their subsidence if administered after their development, and acting whether used with, before or after strychnine. This action is not reciprocal, as strychnine appears to exert little or no influence over paraldehyd-narcosis.

Administration.—Dose, f℥ss–ij. It is best given in small amounts repeated every hour as required, than in a single large dose

(Strahan);* more than gtt. lx are rarely required to produce sleep. Paraldehyd may be administered in capsule or emulsified with acacia and syrup of almonds, which disguises somewhat its unpleasant taste. It has also been exhibited in suppository.

SULPHONAL.

This substance (not official), discovered by Bauman in 1886, is produced by the reactions ensuing between ethyl hydrosulphide, acetone and sulphuric acid, in which diethyl-sulpho-dimethyl-methane ($C_5 H_{12} O_4 S_2$) is formed. It is obtained in colorless, inodorless, insipid, prismatic crystals, almost insoluble in cold water, but miscible in boiling water, 1 to 15, remarkable for its stability, and the resistance it opposes to alkalies, acids (except $H_2 SO_4$ and HNO_3) and oxidizing agents.

INCOMPATIBLES.—On account of its insolubility in the ordinary menstrua it should be prescribed alone.

AIDS.—Morphia increases its hypnotic effect and may be given with it in the same capsule.

PHYSIOLOGICAL EFFECTS.—The action and uses of sulphonal have been carefully studied by Égasse,† Hogarth,‡ and Schick,§ the latter experimenting upon frogs and rabbits by hypodermic injection. Égasse finds that unlike paraldehyd and chloral it does not disturb digestion, alter the blood-pressure, nor affect the respiration of dogs, even in toxic doses, though it induced profound sleep. Upon canine locomotion a large quantity causes trembling of the gait, locomotion being difficult, the animal finally sinking into deep slumber. Schick concludes, after a number of experiments by his method, that it does not affect the motor-nerve irritability, the sensory nerves, or cardiac action, beyond a slight acceleration, but that it lowers reflex activity, quickens the pulse slightly, raises the arterial tension, and depresses respiration, the latter uninfluenced by section of the vagi. Sulphonal is eliminated by the kidneys as an organic sulphide, not yet isolated, without altering the quantity of nitrogenous matters excreted in the urine.

TOXICOLOGY.—Toxic doses cause painful convulsions, muscular resolution, stupor and death. An autopsy made upon animals killed by sulphonal showed violent congestion of the kidney-medullary substance, as well as the same condition about the cerebral and spinal meninges. A fatal instance* is reported of poisoning by sulphonal, which, however, must be considered as most unusual considering the quantity swallowed, of a woman who succumbed to two doses of gr. xv each, taken at intervals of 1¼ hours. Profound sleep ensued, followed by failure of respiration, and death in 40 hours.

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* *Lancet, London*, Jan. 1885.

† *Bull. Gén de Thérap.*, 1889, p. 210.

‡ *Lancet*, London, Oct. 12, 1889.

§ *Journ. of Nervous and Mental Dis.*, 1889, p. 32.

Medicinal Uses.—The use of this medicament is limited to the production of sleep, and to calm excitement as in simple *insomnia, acute mania, dementia, alcoholism, neurasthenia* and *melancholia.* Its action is usually slow, at times wanting. It possesses no analgesic power. Such sequelæ, after awaking, as fatigue and continued somnolence have been noted.

Administration.—By reason of its insolubility, it may be given in capsule, previously well pulverized, and should be taken after a meal, about 2 hours prior to the required sleep. Dose for infants, gr. iii–vi; adults, gr. xv–xxx.

HYPNONE.

This substance (not official), phenyl-methylacetone, acetophenone, or acetaphone, is a recent addition to the narcotic group of remedies. It is a fluid having a sp. gr. of 1.032, crystallizing in large flakes at about 50° F. Its properties have been investigated by Popoff, Dujardin-Beaumetz, Laborde,† Magmen‡ and others, who have ascertained that it possesses decided hypnotic properties. Injected into the vein of a dog it caused sleep, analgesia, absence of the ocular reflex, dilated the pupils, and killed by asphyxia (Laborde). It is eliminated in part by the lungs, its odor being perceptible upon the breath. Large doses are said to irritate the stomach. What the toxic dose is has not yet been determined, though as much as gtt. vj–viij have been taken without disagreeable effects.

It is probably indicated in the same range of diseases to which paraldehyd is applicable, especially in uncomplicated *insomnia.* Dose, gtt. ij–v, or perhaps more, in capsule or with glycerin and syrup.

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* *Med. News*, Aug. 10, 1889.

† *Compt. Rend. des Séances de la Soc. de Biol.*, t. II, Oct., 1885.

‡ *Thèse*, Lyon, 1886.

URETHAN.

Urethan ($C_3H_7NO_2$), not official, is ethyl carbamate and occurs in white crystals, odorless, almost tasteless, and readily soluble in water. Its effects have been studied by Garnier,* Hübner and Stricker,† and others. It acts principally on the cerebrum, at first stimulating but soon depressing its functions and inducing, in suitable cases, *tranquil sleep*, usually without unpleasant after effects. According to Gordon's‡ investigations the circulation and respiration are somewhat depressed, the reflexes lowered. Small quantities (gr. v–x) increased the excretion of urea, while large diminished it, with no effect on animal heat. It is not an analgesic, and will not produce sleep when insomnia is due to pain. It is feebly toxic, causing in overdoses insensibility and coma, though ʒiij have been taken without alarming results. Large doses of urethan decrease the nitrogenous elements of the urine, by which fluid it is excreted (Garnier).

MEDICINAL USES.—As an hypnotic it is useful in simple *insomnia* when other remedies are contraindicated on account of their action on the heart and respiration. It has been given also with benefit in *epilepsy*, *chorea* and *uremic convulsions*. In large doses it is antagonistic to strychnine, but is not sufficiently powerful to be used as an antidote to that poison. The dose ranges from gr. ij–ʒj, or more, dissolved in water and flavored with elixir of orange. Hypnotic effects can usually be produced by doses of gr. xv–xxx in suitable cases. Capsules may be used as a means of administration.

BELLADONNA.

Belladonnæ Folia, Belladonna Leaves; Belladonnæ Radix, Belladonna Root.

Atropa Belladonna, or Deadly Nightshade (*Nat. Ord.*, Solanaceæ), is a European perennial plant, with herbaceous, branched downy stems, about three or four feet high, large ovate leaves of a dull-green color, and drooping, bell-shaped purple flowers. The whole plant possesses narcotic properties, but the LEAVES and ROOT only are official. The root should be obtained from plants more than two years old; the dried root is long, round, from one to seven inches in thickness, branched, of a reddish-brown color, of little odor, and a feeble sweetish taste.

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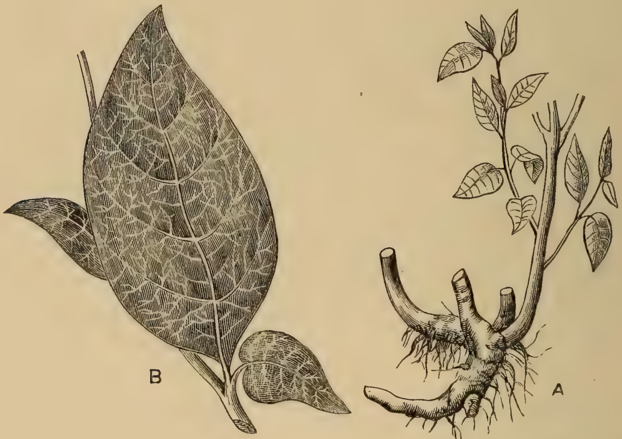
* *Revue Méd. de l'est*, 1886, p. 126.

† *Deutsche Med. Wochensch.*, April, 1886, p. 236.

‡ *Brit. Med. Journ.*, Nov. 2, 1889.

Chemical Constituents and Tests.—The physiological properties of belladonna depend on the presence of an alkaloid termed *atropine*, combined with *malic acid*, which is found in all parts of the plant. It is official, and is prepared from the root by exhaustion with alcohol, afterward adding sulphuric acid, precipitating with potassa, dissolving the atropine in chloroform, and then evaporating the chloroform. Atropina (*Atropine*) ($C_{17}H_{23}NO_3$) occurs in the form of yellowish-white, silky, prismatic crystals, without smell, but of a bitter, acrid taste, soluble in alcohol, more so in ether, still more so in chloroform, but only partially soluble in water. The best *test* is bromine, in hydrobromic acid, which produces a yellow amorphous precipitate, soon becoming crystalline, and will detect at least gr. $\frac{1}{25000}$ (Wormley); auric chloride gives with atropine solution a yellow amorphous precipitate; the physiological test should also be applied by dilating the pupil of a rabbit or a cat by local application to the eye. It is a most energetic poison, producing analogous effects to those of belladonna, but much more powerful. Another alkaloid termed *belladonnine* has been isolated, which, according to Ladenburg, is isomeric with hyoscyamine and atropine. It has, however, a lower fusing point, and yields a different salt with gold chloride.

Fig. 6.



ATROPA BELLADONNA: A, ROOT; B, LEAVES.

Incompatibles.—Prolonged contact with the caustic alkalies decomposes atropine and its salts, ammonia being liberated. The alkaloids atropine, hyoscyamine and daturine, alone or combined, are incompatible with tannin and vegetable infusions containing the same, an insoluble tannate being formed.

Aids.—Stramonium, hyoscyamus and duboisia possess analogous effects.

Physiological Effects.—The authorities consulted for this article are Meuriot,* Fraser,† Bezold and Bloebaum,‡ Lemaitre,§ and Donders.‖ Belladonna or atropine applied *locally* diminishes sensation and can be absorbed through the unbroken skin. Brought in contact with the temporal region belladonna causes dilatation of the pupil; and accompanying its mydriatic action there is paralysis of accommodation and a diminished intra-ocular pressure. Nervous system: in small doses it is a cerebral exhilarant, tending in larger doses to produce hallucinations and delirium. The exact quantity required to induce these effects cannot be stated, as individual susceptibility differs. Belladonna dilates the pupil, in whatever way exhibited. When dropped into the eye it brings about dilatation probably by paralysis of the end-organs of the third nerve and stimulation of the sympathetic, while internally it is also thought to cause pupillary dilatation by a local action. In large doses the excitability of the motor and sensory nerves is impared by this drug, but the contractility of striated muscles remains unaltered. It tetanizes the cord, and heightens its reflex function (Ringer, 11th ed., p. 401). Circulation: it increases the heart's movements by stimulating the cardiac ganglia of the sympathetic and paralyzing the peripheral ends of the pneumogastrics, and as it excites the vaso-motor centre, an increase in blood-pressure also takes place. Respiration: this is quickened by stimulation of the respiratory centre. Temperature: in small doses it raises the temperature and in large, reduces it. Secretion: belladonna checks the salivary secretion by paralyzing the peripheral endings of the chorda tympani nerve in the submaxillary gland, hence the dryness of the mouth and throat experienced after its use. Its effect on the urinary secretion is doubtful, but it unquestionably augments the solids; it effectually checks the perspiration by a local paralyzing action on the peripheral nerve-end organs; upon the intestinal glands its action is uncertain, though it certainly induces intestinal peristalsis. Atropine is eliminated by the kidneys. Belladonna, however used, has the power to check the secretion of the mammary glands. In larger doses it causes *dilatation of the pupils*, loss of vision, giddiness, constriction of the throat, difficulty of deglutition and articulation, increased heart-action, quickened respiration, elevation of temperature, nausea, with occasional vomiting and purging, and sometimes a red eruption.

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* "De la Méthod. Phys. de la Belladonne," 1868; an elaborate monograph.

† *Trans.* Roy. Soc. Edin., 1869, p. 449.

‡ *Würzburger Physiol. Untersuchungen,* 1867, p. 3.

§ *Arch. Gén. de Méd.*, VI, 6 ser., p. 173.

‖ "Accom. and Refrac. of the Eye," 1864, p. 558.

Toxicology.—When excessive doses are taken the temperature of the body falls, the muscular system is relaxed, sensation is impaired, the pulse fails, and maniacal delirium sets in, followed by coma, syncope and death, often preceded by convulsions. The fatal dose of atropine cannot be precisely stated, as death has followed gr. $\frac{1}{12}$ per orem,* while recovery took place after swallowing gr. jss, and gr. xxx–xxxv of the extract of belladonna taken by a child in mistake for liquorice.† Post-mortem examinations show that the action of the poison is not confined to the cerebro-spinal system, there being evident inflammation of the digestive organs.

Antidotes.—Poisoning by belladonna is treated by evacuation of the stomach, cathartics, and, if coma occur, by the electro-magnetic battery. *Pilocarpine* and *physostigma* are the physiological antidotes, or hypodermic injections of morphine may be administered for their stimulating effect upon the respiratory centres (see opium). As atropine and its salt is decomposed and rendered inert by prolonged contact with the caustic alkalies, the solutions of potassa and soda are recommended as antidotes for belladonna; with tannin an insoluble tannate is formed.

Medicinal Uses.—Belladonna is one of our most highly esteemed *anodyne* and *antispasmodic* remedies. It is destitute of hypnotic effect, and, on the contrary, has a tendency to occasion wakefulness. In the treatment of *neuralgia* (extract, gr. ss) it ranks at the head of the narcotics, and is extensively employed both alone and with quinine sulphate (gr. x) and general tonic treatment. In *myalgia*, *lumbago* and *sciatica*, the subcutaneous injection gives speedy relief and may be advantageously combined with morphine. It should be given until dryness of the throat, dilatation of the pupil, or some disorder of vision are produced. Its powers of allaying spasm have been found very efficacious in the treatment of *whoop-*

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* *Journ. de Chimie Méd.*, 1860, p. 529. Roux.

† *Cincinnati Lancet and Observer*, 1861, p. 609.

ing-cough, in which atropine sulphate gr. $\frac{1}{200}$ may be given in water once daily to children of from one to four years of age, diminished or increased according to the severity of the paroxysms and the effect produced. In *asthma*, a nightly dose at bedtime large enough to produce constitutional effects often prevents the paroxysm and, in some cases, cures the disease. In *colica pictonum* (see lead) and in *laryngismus stridulus*, belladonna ranks among the best antispasmodic remedies. In the latter disease, combined with the bromides, and, in the absence of laryngitis, repeated sponging of the neck with cold water, it is most efficacious. Prescribed with ergot it is often serviceable in *exophthalmic goitre*.

Combined with opium in suppository, it is used for the relief of *dysmenorrhœa*, but is only palliative, as the treatment of this symptom depends upon its cause. It has been occasionally employed with advantage in *epilepsy*. As a stimulant to the circulatory system, it may be used wherever *syncope* is threatened from cardiac failure. By its influence in relieving irritability of the bladder, it is probably the best remedy for the nocturnal *incontinence of urine* of children, for which purpose gtt. iij–v of the tincture may be cautiously given three or four times a day, and the child waked at midnight to pass water.

In habitual *constipation* due to atony of the muscular fibre, after a dose of castor oil, the following is efficacious to reëstablish peristalsis: ℞ Extracti belladonnæ gr. $\frac{1}{20}$; aloin gr. $\frac{1}{12}$; extracti nucis vomicæ gr. $\frac{1}{8}$. M. ft. pil. I. S. one pill after meals t. d. for some time. Hypodermic injections of atropine gr. $\frac{1}{80}$–$\frac{1}{60}$ are useful in checking colliquative *night-sweats*, especially in phthisis, and may be advantageously combined with minute doses of morphine, to relieve the cough; the following also is a good combination: ℞ Atropinæ sulphatis gr. $\frac{1}{10}$; strychninæ sulphatis gr. $\frac{1}{5}$; codeinæ gr. x; aquæ f℥iiss. M. S. teaspoonful morning and evening. Hypodermics of atropine, well combined with morphia, are often serviceable in *spinal irritation* and *torticollis*, and should be injected near the seat of pain.

And, lastly, from its anhydrotic action, atropine is useful in *mercurialismus*.

As a *topical* remedy, belladonna is employed as an anodyne to *carbuncle*, *boils*, and *abscess*, and also to relieve rigidity of the os uteri in *labor*, and in spasmodic *urethral stricture*, the application of the ointment to the constriction by a bougie is efficacious. A plaster, ointment or solution of atropine may be applied to the breasts of nursing women as a *galactafuge;* while the plaster alone, to the back, often relieves *lumbago* and *sacralgia.* The liniment may be used to relieve *rheumatism, muscular* or *gonorrhœal, neuralgia* and other local pains, and is advantageously combined with fluid extract of aconite as a topical remedy in severe *neuralgia.* A suppository (gr. ss–j of the extract) is often sufficient for the relief of *strangury,* and to allay the hyperæsthesia about the prostate and deep urethra in *spermatorrhœa,* and in *acute cystitis* this, combined with a milk diet and rest in the recumbent posture, at the same time keeping the urine alkaline by liquor potassæ, is one of the best plans of treatment. The local use of atropine in diseases of the eye is of the greatest importance; solutions of the alkaloid or its sulphate (gr. i–ij to f℥ss. of water), may be dropped into the conjunctival sac, to relieve pain and *photophobia,* to determine the refraction of the eye from its influence on accommodation, in the diagnosis of suspected *cataract,* in operations for cataract, *prolapsus iridis,* and *ulcers of the cornea.* A good treatment for *iritis* is the instillation of atropine solution until the pupil is widely and evenly dilated, at the same time giving mercury internally, and continuing all until the danger of synechia is passed. Gelatin-wafers, containing gr. $\frac{1}{50}$ to $\frac{1}{150}$ of atropine, are used to dilate the pupil for ophthalmic purposes. It should be recollected that the local application of belladonna, or its alkaloid, may produce the constitutional effects of the drug.

Homatropine.—This is made from tropine amygdalate and dilute hydrochloric acid, atropine having been split into tropine and tropic acid. It is similar in its effects to atropine, though weaker, retarding the heart's action, and rendering it irregular. Applied to the pupil, it quickly bring brings about wide dilatation, and, moreover, is unirritating, hence it is an acquisition in ocular therapeutics, as *iritis* and *prolapsus iridis.*

Administration.—The dose of the powder of the root or leaves is gr. j, to be repeated and increased till dryness of the throat, dilatation of the pupil, and dimness of vision are produced. The *abstract* is twice as strong as the powdered root, from which it is prepared. The *tincture* (15 parts of the leaves to diluted alcohol q. s. to make 100 parts of tincture—dose, gtt. 15 to 30) and the *alcoholic extract* are also official. Of the *fluid extract of belladonna root* the dose is ♏j–v. For external use, a plaster (*emplastrum bel-*

ladonnæ), an ointment (*unguentum belladonnæ*, a useful anodyne application in *adenitis*, *herpes zoster*, *chilblain* and with opium, to *hemorrhoids*), and a liniment (*linimentum belladonnæ*, containing fluid extract 95 per cent., and camphor 5 per cent.) are employed.

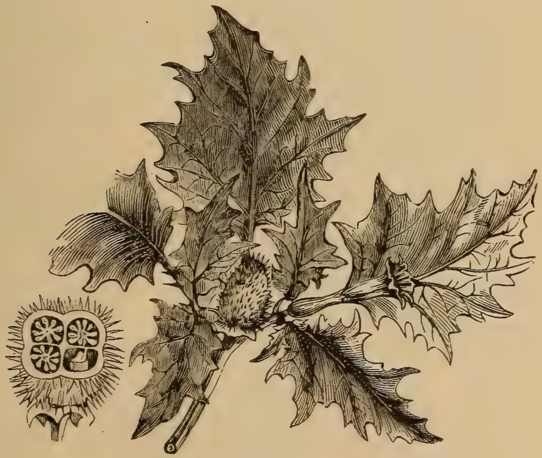
ATROPINA (*Atropine*), or its official salt ATROPINÆ SULPHAS (*Atropine Sulphate*), is generally employed medicinally instead of belladonna, as it represents the activity of the drug, because of the smallness of the dose required, and its fitness for hypodermic use. The *sulphate*, which is obtained by mixing the alkaloid with water, and gradually adding diluted sulphuric acid until the alkaloid is dissolved and the solution neutral, when the salt is obtained by evaporation, consists of a white, slightly crystalline powder, very soluble in water and alcohol, but insoluble in ether. As a medicinal agent, the salt is preferable because more soluble. Dose, gr. $\frac{1}{120}$–$\frac{1}{60}$.

STRAMONIUM.

Stramonii Folia, Stramonium Leaves; Stramonii Semen; Stramonium Seed.

Datura Stramonium, or Thorn-Apple, sometimes called Jamestown weed (*Nat. Ord.* Solanaceæ), is an annual indigenous plant, which grows very abundantly in waste grounds in all parts of the world. It has a forked, branching stem, from three to six feet high, ovate, toothed leaves, large funnel-shaped white or purplish flowers, which appear in midsummer, and ovate capsules, filled with numer-

FIG. 7.



DATURA STRAMONIUM. A, SEED.

ous kidney-shaped, brownish-black seeds. The odor of the plant is strong and disagreeable, and its taste bitter and nauseous. It loses these properties very much when dried, but the process does not appear to weaken its narcotic qualities. The LEAVES and SEEDS are official, but the seeds are most powerful from containing most daturine.

Chemical Constituents.—The active principle of Stramonium is an alkaloid termed *daturine*, found combined with *malic acid*, which is chemically identical with atropine, and possesses analogous properties.

Physiological Effects.—The action of stramonium is *closely allied* to but weaker than that of belladonna. From its common occurrence in every part of the country, cases of poisoning from this weed are very frequent, particularly with children, who are fond of swallowing the seeds. A case is reported by Calkins * of a boy aged four years, who swallowed a tablespoonful of the seeds, but, as he soon vomited them, no ill effects resulted. The treatment laid down for the relief of poisoning from belladonna is applicable to these cases. It is eliminated † by the urine.

Medicinal Uses.—It is sometimes prescribed *internally* in *neuralgia;* and in *asthma*, gr. xxv of the dried leaves are smoked with great relief in cigarettes or pipes, the smoke being drawn into the lungs and the inhalation frequently repeated. *Topically*, daturine is occasionally used by oculists to *dilate the pupils* when other mydriatics cannot be employed. Stramonium is an excellent anodyne application, in the form of cataplasm and ointment, to *irritable ulcers*, *bed-sores* and *hemorrhoids*.

Administration.—The dose of the powdered *leaves* is gr. ij; of the *seeds*, gr. j, to be repeated and gradually increased till effects are produced. Dose of the *extract* (of the *seed*) gr. ½. The *fluid extract* (dose ♏ij–v), the *tincture* (10 per cent. of the seed, dose ♏v–xxx), and the *ointment*, made by mixing the extract with benzoinated lard, are also official.

HYOSCYAMUS.

Hyoscyami Folia, Hyoscyamus Leaves.

Hyoscyamus niger, or Henbane (*Nat. Ord.* Solanaceæ), is a native of Europe, and is naturalized in the northern parts of the

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* *Am. Med. Monthly*, 1856, p. 220.

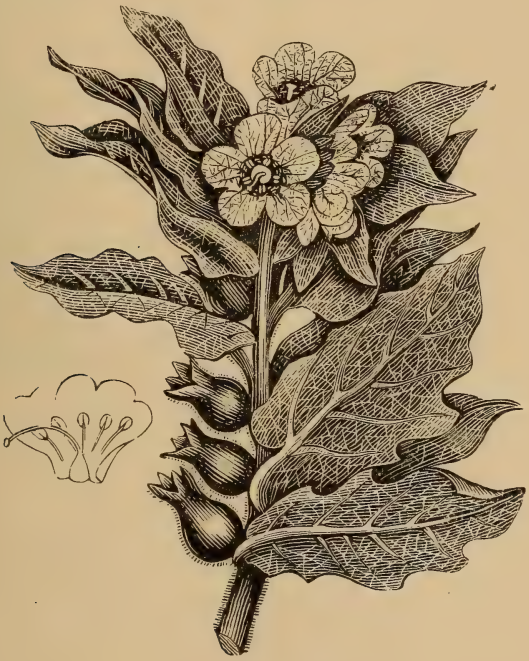
† *Arch. de Physiologie Norm. et Pathol.*, t. iii, 1870, 215. Oulmont et Laurent; De l'Hyoscine et de la Daturine.

United States. It grows to the height of about two feet, with large sinuated, pale-green leaves, and flowers of a straw-yellow color. The whole plant has narcotic properties; but the LEAVES only are official. They should be gathered from plants of the second year's growth when in flower.

CHEMICAL CONSTITUENTS.—The active properties of the plant depend upon two alkaloids, one crystallizable, termed *hyoscyamine* ($C_{17}H_{23}NO_3$), isomeric with atropine; the other an amorphous, brown liquid, to which Ladenburg * has given the name of *hyoscine*, and which, though isomeric with hyoscyamine, differs from it very materially. Hyoscyamine can be split into *tropic acid* and *tropine*, hyoscine into *tropic acid* and *pseudotropinæ;* and both alkaloids unite with acids to form salts.

EFFECTS AND USES.—The effects of henbane on the system much resemble those of belladonna. They differ from those of opium in their comparatively *feeble hypnotic effect*, and in their relax-

FIG 8.



HYOSCYAMUS NIGER.

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* Deutsch Chemisch. Gesellschaft, 1880–81.

ing influence on the bowels. In large doses it causes *dilatation of the pupil*, delirium, loss of vision, and, generally, sleep. *Hyoscyamine*, when pure, is identical in its action with atropine, and recent researches have shown that *hyoscine* is the hypnotic principle of henbane, and that it is antagonized physiologically by pilocarpine (A. Sohrt). They are both eliminated by the kidneys.* Henbane may be used *remedially* in the same diseases as belladonna and stramonium, than which it is, however, less active. It has been administered also in *insomnia*, where opium is objectionable from its constipating or nauseating influence, and as an hypnotic to children. The extract is frequently added to purgative pills in *constipation*, to increase their efficiency and prevent griping. The tincture is occasionally of service as a sedative to the bladder in *acute cystitis*. *Externally*, hyoscyamus is employed in the form of cataplasm or fomentation to painful swellings and *ulcers*, and hyoscyamine sulphate may be used to dilate the pupil, in the same manner as belladonna.

TOXICOLOGY.—Dr. White † describes the case of a woman who took fʒxj of the tincture by mistake for black draught; she became immediately giddy, then delirious, with much dryness of the throat, but eventually recovered. In cases of poisoning, the same general treatment is to be pursued as for belladonna, from which it cannot be distinguished. According to Gnauck ‡ morphine is the best antidote.

Dose of the powder, gr. v–x; of the *abstract*, gr. ss–ij. *Tincture* (15 per cent.), dose, fʒj. An *alcoholic extract* (a preparation of uncertain strength—dose gr. ij, increased until some effect is produced), and a *fluid extract* (dose gtt. x–xx) are also official.

Hyoscyaminæ Sulphas (*Hyoscyamine Sulphate*) occurs in the form of small, yellowish-white scales or crystals, or a yellowish-white powder, deliquescent on exposure to the air, without smell, but possessing an acrid, bitter taste. It is very soluble in water and alcohol. Hyoscyamine is useful in *chorea* and various forms of tremor, § in the dose of gr. $\frac{1}{200}$ hypodermically. It is highly recommended by Brown,[*] and confirmed by Lermoine,[†] to quiet the violence of and produce tranquil sleep without disagreeable sequelæ in *acute mania*, though without curative effect. The dose has been variously stated by different authors, due, evidently, to the variable purity of the drug; as, however, gr. $\frac{1}{40}$ of the *pure alkaloid* has produced violent poisoning,[‡] it is better to begin with gr. $\frac{1}{100}$, and gradually increase the dose until some effect is produced.

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* *Arch. für Experimentelle Pathol. und Pharmacol.*, Vol. XXII. R. Kobert und A. Sohrt; *Arch. de Physiologie Norm. et Pathologique*, t. iii, 1870, p. 215. De l'Hyosciamine et de la daturine par Oulmont et Laurent.

† *Lancet*, July, 1873, p. 8.

‡ *Arch. de Neurologie*, July, 1883.

§ *Med. News*, Jan., 1886. Da Costa.

Hyoscine Hydrochlorate (not official) is freely soluble in water, and resembles atropine physiologically, but produces a more decided hypnotic action and less delirium. Its use is followed by headache and malaise, and Gnauck states that it slows the pulse decidedly. It is said not to cause dryness of the throat. *Topically*, gr. ss to water f℥j, it widely dilates the pupil, though, in this respect, it is less persistent than atropine. It has been administered in *whooping-cough* and *asthma*, and Mitchell Bruce[§] advises it in *mania* and *insomnia*, to relieve the delirium and restlessness. G. Thompson,[||] Medical Superintendent, Bristol Asylum, has used it successfully, gr. $\frac{1}{200}$, repeated, to allay excitement and produce sleep in *acute* and recurrent *mania;* but more experience with it is required in order to determine its range of therapeutical uses. Dose, gr. $\frac{1}{75}$; hypodermically, gr. $\frac{1}{120}$, both to be cautiously used at first.

DUBOISIA—DUBOISIÆ FOLIA.

The leaves of the Duboisia myoporoides (*Nat. Ord.* Solanaceæ), a tree-like shrub of Australia. They are three to four inches long and one inch broad, entire, smooth and lanceolate. An alkaloid, *duboisine*, the salts of which are readily soluble in water, has been isolated, isomeric with atropine and resembling it in action. Duboisine, *internally*, produces almost similar effects to those of atropine, except that the mental excitement, which it causes is followed by stupor. Its effect is best seen on the pupil, which it dilates, no matter how exhibited. It differs from atropine in causing more rapid dilatation and paralysis of accommodation, both of which are more fugitive, and in being less irritating. Its physiological action is antagonized by *opium* and *physostigma*. The use of duboisine is confined to ocular therapeutics. For ophthalmic purposes gr. ij–iv may be dissolved in water, f℥j. (On Duboisia, Norris, Ringer, Seely, Wecker and Bancroft).

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[*] *Brit. Med. Jour.*, November 25th, 1882.

[†] *Congrès. International de Médecine Mentale*, 1889.

[‡] *Lancet*, 1879, I, 474.

[§] *Practitioner*, November, 1886, p. 321.

[||] *Lancet*, February 4th, 1888.

The MYDRIATIC ALKALOIDS of the Solanaceæ, just described, all of which act locally, will be here reconsidered, in order to make the statements relating to them the more easily understood; they are *atropine*, *daturine*, *hyoscyamine*, *hyoscine* and *duboisine*. It is now generally admitted that they are all isomeric, having the formula $C_{17}H_{23}NO_3$, and, except hyoscine, are all clearly allied in physiological action. According to Prof. Wormley, atropine, daturine, hyoscyamine and duboisine respond similarly to the bromine and Vitali's tests. Hyoscine, found only in Hyoscyamus niger, is distinguished by possessing an hypnotic action, and in being an amorphous, brown liquid. Belladonnine is also an isomer of these alkaloids, but its effects have not yet been investigated. All possess basic properties, and, with acids, unite to form salts readily soluble in water; and, lastly, atropine and daturine—including hyoscyamine, duboisine and hyoscine—form, with gold, salts that have different fusing temperatures, which in a measure, seem to distinguish them physically.

It is owing chiefly to the investigations of Ladenburg that the chemical relations of these interesting principles have been elucidated.

The mydriatics are employed chiefly to dilate the pupil for ophthalmic examination, as in the diagnosis of cataract, to prevent the iritic adhesions of iritis, and prolapsus iridis in perforating ulcer of the cornea, and to paralyze the accommodation in testing for astigmatism.

THE MYOTIC ALKALOIDS.—These are *eserine*, *pilocarpine*, *nicotine* and *muscarine*, the alkaloid of the Amanita Muscara, or fly-fungus. They differ from their congeners in not being isomeric, and belong, except nicotine, to different botanical orders. Their action is a local one. The myotics, which have a lesser range of utility than the dilators, are used to contract the pupil in photophobia, to counteract the effects of the mydriatics, and alternately with them, to break up adhesions of the iris.

CANNABIS AMERICANA—AMERICAN CANNABIS.

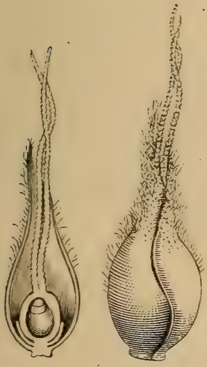
CANNABIS INDICA—INDIAN CANNABIS (FEMALE PLANT).

Cannabis sativa, or Hemp (*Nat. Ord.* Urticaceæ), is a native of Persia, and is cultivated in Europe and in the United States. Narcotic virtues were formerly thought to exist only in the C. Indica, or Indian variety of the plant, but recent investigation seems to show that the hemp plants raised in the Southern States, as Kentucky, are active, and might replace the East Indian drug.

Gunjah is the dried compressed female flowers; *churrus* is an impure resinous exudation, while *bhang* consists of the broken stalks and leaves made up with fruits; it is known as *hashish.*

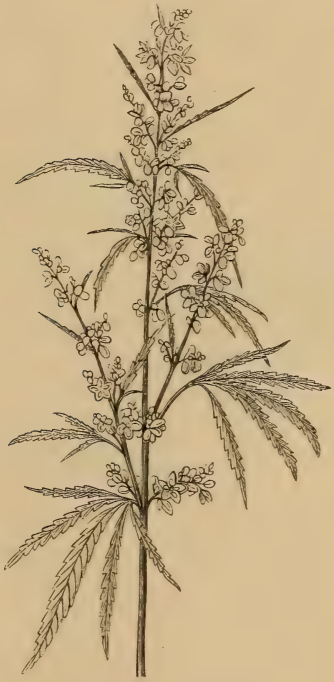
CHEMICAL CONSTITUENTS.—C. Americana is the *C. Sativa grown in the Southern United States and collected while flowering;* C. Indica is the FLOWERING TOPS of the *female plant of C. sativa grown in the East Indies.* By evaporating a concentrated alcoholic solution of the latter, an EXTRACT is obtained (*extractum cannabis Indicæ*), which is the form usually employed. *Extract of hemp* is of a dark, olive-green color, a fragrant, narcotic odor, and a bitter, acrid taste. It is soluble in alcohol and ether, but not in water. The resin, which is

FIG. 9.



CANNABIS SATIVA.
(Female Flower.)

FIG. 10.



CANNABIS SATIVA.
(Female Plant.)

the active principle (Égasse),* has received the name of *cannabin.* A volatile oil has been isolated, decomposable into *cannabene* and *cannabene hydride.* Several alkaloids, it is claimed, have been discovered in small amounts, of which the principal are *cannabinine* and *tetanocannabine,* the latter so named because it possesses tetanizing effects similar to strychnine. According to Jahns,† the only alkaloid existing in C. Indica is *choline,* and the principles termed cannabinine and tetanocannabine are simply impure choline.

AIDS.—Liquors, wines, cocaine and ether enhance its cerebral effects.

PHYSIOLOGICAL EFFECTS.—Indian hemp is without *local* action. Nervous system: in medicinal doses it exerts a peculiar exhilarating effect upon the brain, the mental excitement induced by it being of an agreeable kind, and in this condition ideas flow readily, and *conception of time is lost.* Not infrequently the delirium and cerebral excitement induced by hemp causes the individual, particularly the Hindoostanis, to do deeds of violence, but it does not act upon all alike. A prominent symptom after a full dose is a sense of weight about the extremities, accompanied by a loss of muscular power, and often a cataleptic state; there is also cutaneous anæsthesia. Sleep follows the intoxicating effects of hemp, and the individual on awakening is unconscious of what has happened, but suffers from depression. It has no action upon respiration, circulation or the secretions, but is said to increase the appetite, and aphrodisiac properties have been attributed to it. It is unknown how it is eliminated. Though lethal doses of hemp have produced alarming symptoms, there are no recorded fatal cases.

MEDICINAL USES.—Indian hemp is not much used nowadays except in asylum practice. It has, however, been employed with success in *chorea* and *hysteria;* as a cerebral stimulant in *melancholia* and *insanity;* ‡ to relieve the pain of *dysmenorrhœa*, especially when dependent on uterine fibroids, and for this end the extract (gr. ½) or tincture (♏ v) may be administered; and occasionally as an anodyne in *neuralgia.* In *acute dysentery* the tincture ♏ xv t. d. after meals is recommended (Rennie); § and ♏ v–x repeated, is very useful in dyspeptic *diarrhœa*, accompanied by defective action of the liver, in which the stools follow shortly after meals; and in the *anorexia* succeeding the prolonged fevers.* It has also been given with advantage as an hypnotic in both *mania* and *mania-a-potu*. Dose, gr. ss–ij or more. A *tincture* (20 per cent., dose ♏v–xxx), and a *fluid extract* (*extractum cannabis Indicæ fluidum*) are also official; dose, ♏j–xv. As various samples of cannabis differ much in strength, it is better, when first using a new one to begin with the minimum dose, to avoid unpleasant effects.

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* *Bull. Gén. de Thérap.*, 1890, t. 118.

† *Arch. der Pharm.*, 1887, p. 479.

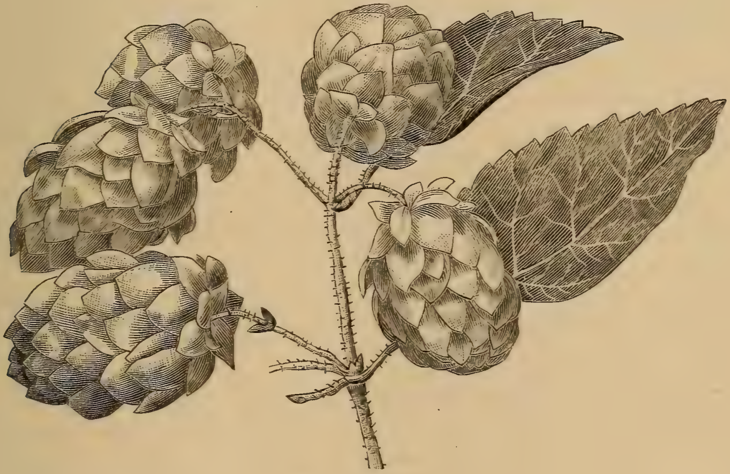
‡ *Brit. Med. J.*, 2d vol., 1891, p. 12.

§ *Indian Med. Gazette,* Dec., 1886.

HUMULUS--HOPS.

Hops are the STROBILES of Humulus Lupulus, or Hop-vine (*Nat. Ord.* Urticaceæ), a climbing vine, indigenous in Europe, and probably also in North America, with serrated, rough leaves and greenish-yellow flowers. The medicinal portion is the fruit, or STROBILES, which are also largely employed in the preparation of malt-liquors, and are known as *hops*. Near their base are two small, round, dark seeds, covered with aromatic glands or grains, which are the active portion of the hops, and are termed *lupulin*. They are separated by threshing, rubbing and sifting the scales, and constitute from a sixth to one-tenth part of the weight of hops.

FIG. 11.



HOPS, STROBILES.

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* *The Practitioner*, London, Feb., 1888, p 95. J. F. P. McConnell.

Lupulinum (*Lupulin*) is official, and when fresh is a brownish-yellow granular powder which has the aromatic odor and bitter taste of hops. Microscopically it consists of two hemispheres; the lower somewhat conical, the upper top-shaped, and both reticulated; within these is found a yellowish substance resembling vegetable pollen. Lupulin is slightly soluble in water and is composed of a *volatile oil*, a bitter principle termed *lupulite*, *resin*, *tannic acid* and other matters. The scaly bracts contain a small portion of lupulinic matter.

Effects and Uses.—Hops are *tonic* and *feebly narcotic*. The narcotic properties probably reside in the volatile oil, and the tonic properties in the bitter-principle. They are said, also, to possess anaphrodisiac and astringent virtues, and sometimes prove diuretic. The odorous emanation is employed as an hypnotic by means of the hop-pillow. *Internally*, they are given to relieve *insomnia*, and prevent *chordee* (in form of lupulin), and are also employed for their stomachic and tonic effect. The combination of tonic and hypnotic virtues renders hops an excellent remedy in mild forms of *mania-a-potu*. *Topically*, they are employed in the form of fomentation or poultice, in *painful swellings* and *tumors*. As a soothing injection in *vaginitis*, and *pruritus vaginæ*, hops ℥j infused in boiling water Oij is recommended by Atthill,* and its efficiency is increased by the addition of borax ʒj.

Administration.—Hops are given in the form of infusion (not official—dose f℥ij–iv), and *tincture* (dose fʒj–iij).

The best preparation for internal use is Lupulin, in the dose of gr. v–xij, in powder or pills. The *fluid extract of lupulin* may be used in doses of fʒss–ij. It is best given mixed with a little syrup and then largely diluted. The *oleo-resin* also is official; dose, ♏ij–xxx.

DULCAMARA.

The young branches of Solanum Dulcamara, the Woody Nightshade, or Bittersweet (*Nat. Ord.* Solanaceæ), a European vine, naturalized in the United States, possess combined narcotic and diaphoretic properties. The active principles are a poisonous alkaloid termed *solanine* ($C_{42}H_{87}NO_{15}$?), which has been found also in S. tuberosum, or common potato, and S. nigrum, or black nightshade, and a glucoside, *dulcamarin* ($C_{22}H_{34}O_{10}$).

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* "Diseases Peculiar to Women," 7th ed., p. 26.

Effects and Uses.—In small doses the most obvious effects of bittersweet are an increase in the secretion from the skin and mucous surfaces, with some diminution of sensibility. According to Éloy's* investigations it is hypnotic, analgesic, mydriatic, and in large doses induces vertigo and tinnitus aurium. In excessive doses it is an acro-narcotic poison. Its precise use is not obvious, but as an analgesic it might be serviceable in *neuralgia*. A *fluid extract* is official; dose, f℥j, largely diluted.

ORDER II.—ETHEREAL ANÆSTHETICS.

The term Anæsthetics (from α, *non* and αἴσθησις, *sensation*), properly speaking, includes all agents which diminish sensibility and relieve pain. It has, however, been used to denominate a class of ethereal remedies which are applied by inhalation, and produce such a condition of temporary insensibility as to prevent pain during surgical operations and parturition.

The vapors usually employed to produce anæsthesia are those of ETHER and CHLOROFORM. Many other substances have, however, lately been introduced as anæsthetics.

ÆTHER—ETHER.

Ether is prepared by the distillation of alcohol and sulphuric acid, and is afterward rectified by redistillation with solution of potassa. For inhalation, however, it is further purified by being shaken with water, by which it is freed from alcohol, and this, as well as acid contaminations, are afterward removed by the agency of calcium chloride and freshly calcined lime. Thus purified, it is designated as Æther Fortior—Stronger Ether.

Although commonly termed sulphuric ether, in allusion to the sulphuric acid used in its preparation, yet ether contains no sulphuric acid. By the action of the acid upon alcohol, ether is formed by the substitution of ethyl (C_2H_5) for one atom of hydrogen in alcohol ($C_2H_5H\,O$), and is ethyl oxide $(C_2H_5)_2O$.

Ether is a transparent, inflammable, colorless liquid, with a strong, fragrant odor and a hot, pungent taste. It wholly evaporates in the air, so rapidly as to cause a considerable degree of cold; combines with alcohol and chloroform in every proportion, and dissolves in ten times its volume of water. The specific gravity of pure ether is 0.713, of *stronger ether* (consisting of about 94 per cent. of ethyl oxide and about 6 per cent. of alcohol containing a little water) 0.725, of ordinary *official ether* (about 74 per cent. of ethyl oxide and about 26 per cent. of alcohol containing a little water) 0.750. The boiling-point of *stronger ether* is about 98° F.

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* *L'Union Médicale*, 1886, p. 745.

EFFECTS AND USES WHEN SWALLOWED.—When taken into the stomach, ether produces a primary stimulant and secondary narcotic effect, the stage of excitement being, however, very transient. Before the narcotic effects set in, the heart's beats are increased, the face is flushed, and the skin becomes moist. It has long been employed as an antispasmodic and anodyne remedy in *asthma*, *angina pectoris*, *hysteria* and *colic* of the stomach and bowels; and, from its combined stimulant and antispasmodic virtues, it has been found useful in the latter stages of *typhus*, attended by subsultus tendinum, etc. It has been administered to dissolve *hepatic* and *renal calculi*, but its solvent virtues, after entering the blood, in this condition lack confirmation. In *syncope*, f℥ss or more, it is one of the best stimulants to restore the heart's action, and may be combined with brandy or whiskey.

As a *topical* anodyne, ether is a very good application in nervous *headache;* applied by means of an atomizer, it causes local anæsthesia; it has been also used as a cooling lotion in cerebral affections. The *subcutaneous injection of ether* is followed by pain and inflammation around the site of introduction, which usually subsides without suppuration. Thus administered, its systemic effects are more quickly produced than *per orem.* The deep injection is used in *sciatica* and to bring about reaction after hemorrhage, especially *post-partum*, and failure of cardiac action. If evaporation be repressed, when it is applied locally it acts as a rubefacient, and may be employed for counter-irritation.

ADMINISTRATION.—*Dose*, f℥ss–j, to be increased when habitually used. It may be incorporated with water by rubbing it up with spermaceti, in the proportion of gr. ij to ether f℥j, or it may be given in capsules of gelatin.

AIDS.—Alcohol and chloroform enhance its effect upon the brain; by inhalation, chloroform.

CONTRAINDICATIONS.—It should not be exhibited where disease of the heart or brain, or serious obstruction of the lungs, exists, or when from any cause there is unusual tendency to syncope, and precaution should be taken to guard against asphyxia; but when administered with proper care and discrimination, it is attended with little or no danger or unpleasant results of any kind.

EFFECTS WHEN INHALED.—The first effects of the inhalation of ether are a sense of strangulation and cough, from its local irritant action. When the vapor is absorbed into the system through the pulmonary surface, the nervous functions are successively and progressively affected. The mental faculties and volition become first impaired; insensibility and unconsciousness rapidly supervene *during which susceptibility to pain is lost,* and the patient lies in a trance-like sleep, resembling death. This condition is often preceded by one of excitement, during which patients sometimes weep, laugh, moan, sing, rave, or present pugnacious manifestations. In the beginning of etherization the circulation is accelerated, but it is afterward depressed. The period of full ether narcosis lasts from five to ten minutes, and the patient ordinarily recovers without serious inconvenience, although headache, nausea, drowsiness and languor sometimes ensue for a few hours. Occasionally, congestion of the brain or lungs, cataleptic rigidity with prolonged insensibility, and, in females, hysterical phenomena, ensue after etherization; but these effects are uncommon, and it is believed that death has rarely followed the use of ether when care has been taken to admit atmospheric air into the lungs along with the ether. During the stage of insensibility, convulsive twitches or muscular rigidity are occasionally noticed; the breathing is somtimes stertorous; the iris becomes fixed; the pupils are dilated; the eyeballs are upturned; and the orbicularis palpebrarum does not contract when touched. Insensibility to pain in some cases takes place before unconsciousness; and when patients are recovering from the latter state the mental faculties are often completely restored, while insensibility to pain continues. A brief period of anæsthesia, lasting less than a minute, has been noticed to occur before complete insensibility, which may be taken advantage of for short operations. It has been shown by Flourens and Longet that when ether-narcosis is fully established the functions of the nerve-centres are involved in the following order, viz., the *cerebrum,* the *sensory centres* of the *cord,* the *motor centres* of the *cord,* the *sensory centres* of the *medulla oblongata,* and lastly, the *motor centres* of the *medulla oblongata.* The functions which continue to act are those presiding over circulation and respiration.

Since the year 1842, the inhalation of ether—first resorted to in our own country by Dr. Crawford W. Long, of Athens, Ga., and shortly afterward by Morton, a dentist—has been practiced very generally in all parts of the world, with the greatest success, *for the prevention of pain in surgical operations;* and its use has been also extended, with the happiest results, to the relief of pain in *labor.*

The quantity of ether necessary to effect etherization is about two ounces; and it may be conveniently applied by means of a cone of stiff paper, shaped so that its base will fit over the nose and mouth of the patient, and into which a napkin or small towel, or hollowed-out sponge, is placed; the sponge should be first soaked in warm water, squeezed dry, and saturated with pure ether. It is then applied to the mouth and nostrils, the mouth being permitted occasionally to receive atmospheric air; and, if irritability of the air-passages occur, this is to be gradually overcome. From three to thirty minutes are required to produce insensibility, and its occurrence is known by the closure of the eyelids (if they have been previously open), failure to respond to questions, and muscular relaxation. The sponge is then to be removed, and may be reapplied from time to time if necessary.

Etherization is less apt to produce nausea if practiced upon an empty stomach, and the administration of a little brandy and laudanum promotes its action.

TOXICOLOGY.—The inhalation of ether is not entirely safe, as Dr. Lyman * has collected a number of fatal cases (37). To revive the respiratory movements when suspended by ether-narcosis, the agents that must be employed are artificial respiration, faradization of the thoracic muscles, and inversion of the body according to Nélaton's plan.

MEDICINAL USES.—Etherization has been resorted to in a variety of morbid conditions in which the administration of narcotics and antispasmodics has not proven potent enough. It exerts a powerful control over the violent types of spasmodic disease, and has been prescribed with advantage in *hysteria*, *tetanus*, *strychnine poisoning*, to prevent a paroxysm of *asthma*, *chorea*, *convulsions*, *puerperal eclampsia*, to alleviate the pain of *biliary* and *nephritic colic*, as a relaxant in the diagnosis and reduction of *dislocations*, in the examination and setting of *fractures*, for taxis in *hernia*, the breaking up of adhesions, and in the diagnosis of *malingering*. The extent to which etherization should be pushed, varies of course, with the nature of the disease and the acuteness of the pain. During the passage of calculi, for instance, it should be carried to the point of relieving the pain, while in dislocations complete anæsthesia is necessary.

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* "Artificial Anæsthesia, etc.," 1881, p. 289.

To relieve the pain of *labor*, complete narcosis should not be produced, as cessation of uterine contractions and loss of uterine retractility may result, leading to a delay in the delivery, retention of the placenta, and even post-partum hemorrhage. It should only be administered during the pains and intermitted between them, thus abating the suffering without abolishing voluntary efforts at expulsion.

Instrumental or manual interference with labor may render complete anæsthesia necessary, or it may be desirable temporarily to aid in the relaxation of a rigid cervix, or to prevent the woman from bearing down when the perinæum is endangered by a too rapid delivery.

Local anæsthesia and congelation may be produced through the agency of the ether spray applied to a part by the atomizer.

CHLOROFORMUM—CHLOROFORM.

Chloroform is usually obtained from the distillation of alcohol with chlorinated lime, and for medicinal use,

Commercial Chloroform (*Chloroformum Venale*) (containing at least 98 per cent. of chloroform) is purified by agitation with one-fifth of its weight of sulphuric acid, which destroys the contamination of chlorinated pyrogenous oil; and the sulphurous acid formed and the water present are afterward removed by means of a watery solution of sodium carbonate and of stronger alcohol and lime. The purest chloroform for internal use is now made from chloral hydrate. Recently, (1891), it has been found possible to purify chloroform by congelation with intense cold.

Purified Chloroform (*Chloroformum Purificatum*) is a colorless, volatile liquid, of a bland, ethereal odor and a hot, aromatic, saccharine taste. It is not inflammable, is slightly soluble in water and freely soluble in alcohol and ether. It has extensive solvent powers, dissolving camphor, the fixed and volatile oils, most resins and fats, iodine, bromine and the organic alkaloids. The purest chloroform has a specific gravity of 1.5022. Official chloroform has a specific gravity of 1.485–1.490 when it contains a little alcohol; and as usually found its specific gravity is about 1.475, when it contains more alcohol, and is less apt to become acid. The boiling point of pure alcohol is 142° F. It is chemically classed with the triatomic haloid ethers and is methenyl chloride ($CHCl_3$). Chloroform is sometimes contaminated with chlorinated pyrogenous oil (a very injurious impurity); this may be detected and removed by strong sulphuric acid, which gives the chloroform a color varying from yellowish to reddish brown, according to the amount of impurity. The most delicate test for the presence of alcohol is iron binitrosulphuret, which, when agitated with chloroform, will produce a brown tint if alcohol be present. $Ag.NO_3$ will detect the chlorides.

AIDS.—(See ether.) Locally by rubefacients, as camphor.

CONTRAINDICATIONS.—Chloroform, like ether, should not be administered by inhalation to persons suffering from any serious disease of the brain or heart (especially fatty degeneration), or where any serious obstruction to the circulation exists.

PHYSIOLOGICAL EFFECTS.—The *effects* of chloroform *by the stomach* on the system are *analogous* to those of ether, but much more *rapid* and *powerful*. When *inhaled*, in the dose of a fluidrachm or more, it rapidly induces anæsthetic sleep, with a great relaxation of the muscles, gradual lowering of the blood-pressure, and the most complete insensibility to painful agents. The period at which insensibility occurs varies from fifteen seconds to two minutes, and it continues usually between five and ten minutes, and may be prolonged considerably by renewal of the inhalation. The patient usually recovers without recollection of what has occurred during the state of insensibility, and with few or no uncomfortable sequelæ. Sensibility to pain is often very much obliterated even before consciousness is lost.

Topically applied, and when its evaporation is prevented, chloroform acts as an irritant, and soon vesicates the skin—powerfully diminishing painful impressions during its application.

TOXICOLOGY.—The administration of chloroform has in many cases been attended with fatal syncope. (Lyman* has collected 393 cases), due to alleged heart-paralysis. An elaborate investigation, however, made upon dogs as to its toxic action, conducted by the Hyderabad Chloroform Commission,† seems to negative this statement. They found "that chloroform does not paralyze the heart but kills by stopping respiration." But this conclusion is not in accordance with the results reached by Wood and Hare,‡ who found in their investigations that the heart ceased beating before respiration stopped. Be this as it may, death has ordinarily occurred with such rapidity as to render remedial interference almost unavailable; but at the slightest approach of poisonous symptoms the patient must be placed in the recumbent position, the head lowered and the tongue drawn forward with catch-forceps, cold affusions applied, and, above all, *artificial respiration*, together with electro-magnetism to the respiratory muscles, the inverted position of Nélaton, and injections subcutaneously of ether or ammonia water, should be resorted to.

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* "Artificial Anæsthesia, etc.," 1881, p. 136.

† *Lancet*, London, Jan. 18, 1890.

‡ *Medical News*, Feb. 22, 1890.

MEDICINAL USES.—Chloroform is prescribed by the stomach as an anodyne and antispasmodic, in all cases to which ether is applicable, and has the advantage of a more agreeable taste. It has been found particularly useful to relieve the pain and vomiting of *cancer* of the stomach and also in intestinal *colic* and in *cholera*. For *diarrhœa* and *colic* a good formula is—℞ Spiritûs chloroformi, fʒss; tincturæ capsici, ♏v–x; morphinæ sulphatis, gr. ¼; aquæ, f℥ss. M. S.—One dose. *Externally*, it is used as a topical anodyne. The editor has used the deep injection of chloroform, ♏x–xx in *sciatica*, with good results—the injection being made over the nerve.

ADMINISTRATION.—*Dose*, from ♏xv to fʒss, in sweetened water or mucilage; to be repeated. As an antineuralgic liniment, fʒj to f℥ij of camphor liniment; or as a rubefacient and anodyne, undiluted, on linen, covered with oiled silk, to prevent evaporation. As a wash or gargle, fʒj or ij to water Oj.

The introduction of chloroform as an anæsthetic—which property was first discovered by Sir James Y. Simpson, took place shortly after that of ether; and from its greater intensity of action, its freedom from irritating effect on the bronchial mucous membrane, its more agreeable odor, and its non-inflammability, it has been extensively used, particularly in Great Britain, to the exclusion of ether. A very considerable number of fatal cases have, however, occurred from the inhalation of this agent, where its administration did not appear in any way contraindicated; and it cannot be considered a perfectly safe remedy. It is *employed* as an anæsthetic, anodyne and antispasmodic, to fulfill the indications to which ether is applicable. *In labor* chloroform should not be given until complete dilatation of the os has taken place, the head descending and the pains propulsive.* It should be inhaled only when the pains come on, and there is no doubt that its entire safety in obstetric practice is due to the intermittent plan of administering it. Its non-inflammability, too, in midwifery, should not be lost sight of. By inhalation, when other means have failed, it may prove serviceable to control the spasms of *hydrophobia.* It is also used hypodermically; dose, ♏x–xx.

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* Playfair, 5th ed., vol. 1, p. 353.

The *dose* for inhalation is a fluidrachm, to be repeated in two minutes if anæsthesia be not produced; and its effects may be renewed from time to time without injury. It may be applied on a handkerchief, held near the nose or mouth, care being taken to allow a proper admixture of atmospheric air.

A solution of chloroform in ether has been used in the United States, but, from the unequal volatilization of the two liquids, it must be difficult to modify their effects by combination.

Spiritus Chloroformi (*Spirit of Chloroform*) is a solution of chloroform in alcohol; a convenient form for internal exhibition. Dose, fʒj. Serviceable to relieve *headache* where a mild stimulant is indicated.

Linimentum Chloroformi (*Chloroform-Liniment*) is made by mixing 40 parts of commercial chloroform with 60 parts of soap-liniment. Useful as a stimulating application in *chilblain.*

Mistura Chloroformi (*Mixture of Chloroform*) is made by mixing purified chloroform (8 parts), in which camphor (2 parts) is dissolved, with water (80 parts), by the intervention of fresh yelk of egg (10 parts). Dose, f℥ss-j.[*]

Since the discovery of the anæsthetic properties of ether and chloroform, many other substances have been employed for the purpose of anæsthesia. Of these may be mentioned—

I. **Methylene Bichloride.**—This liquid, introduced to the profession by Dr. W. B. Richardson in 1867 (known also as dichloromethane), is most easily procured by the action of nascent hydrogen

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[*] Under the name of *chlorodyne* a combination containing chloroform is much used, for which the following is a formula: morphine hydrochlorate, 8 grains; oil of peppermint, 16 minims; stronger ether, a fluidounce; extract of liquorice, 2½ Troy ounces; pure chloroform, stronger alcohol, and molasses, each 4 fluidounces; diluted hydrocyanic acid, 2 fluidounces; syrup, 17½ fluidounces; dissolve the morphine and oil in the alcohol, and add the chloroform and ether, mix the liquorice, syrup and molasses, shake the two mixtures, and add the hydrocyanic acid; dose, 5 to 10 minims, the vial to be well shaken. An analysis of Brown's chlorodyne made in 1892 shows it to contain 15 per cent. of chloroform and 2 grains of morphia per ounce.

Numerous other formulæ for chlorodyne have been published, but the above more nearly resembles the original preparation sold under this name. This remedy is often very serviceable in *cholera morbus* and *infantum*, and *acute diarrhœa.*

(developed from zinc, water, and sulphuric acid) upon chloroform. Its composition is CH_2Cl_2. It is a colorless fluid, having a pleasant ethereal odor like that of chloroform, boils at 88° F., has sp. gr. 1.34, and mixes with ether and chloroform in all proportions. The vapor of methylene bichloride is pronounced by Mr. Spencer Wells to be the best known anæsthetic. Given properly diluted with air, *according to his method* (in an experience of more than a thousand cases), it has proved of uniform certainty and rapidity of effect, and free from any dangerous symptoms. It is used in about the same dose as chloroform, but has not been much employed in the United States. Nine fatal cases from its employment are recorded.*

II. **Methylic Ether**, made by digesting methylic alcohol with strong sulphuric acid, is a gaseous substance, lately employed. Under the name of *methyl-ethylic ether*, it has been used, dissolved in ethylic ether, and is said to produce rapid anæsthesia, without spasm, syncope, or asphyxia during inhalation, or subsequent nausea. One or two drachms may be introduced into a bag-inhaler, and the gas is volatilized by means of a hand-bellows.

III. **Nitrous Oxide Gas**, N_2O, was the substance by which anæsthesia was in the first instance produced, in the hands of Mr. Horace Wells, a dentist of Hartford, Connecticut. It is made by the decomposition of ammonium nitrate by heat. It is a colorless, respirable gas, absorbable by water, and the solution, like the gas itself, has a faint, agreeable odor and sweet taste. This gas is both a pleasant and efficient anæsthetic, more rapid and at the same time more transitory in its action than either ether or chloroform, and almost free from disagreeable or serious consequences. Lyman† has collected only four fatal cases which can be fairly attributed to nitrous oxide gas. During unconsciousness it causes considerable mental excitement, shown in various ways, as laughing, crying, etc., and lividity of the face. Buxton,‡ who has investigated its action, sums it up as follows: By trephining a dog and administering nitrous oxide gas, he observed the normal vermilion hue of the superficies change to purple, stasis within the vessels, and the brain substance to increase in size; the cord viewed similarly was found also augmented in volume, so that some cerebro-spinal fluid was squeezed out. In both experiments the results obtained were the reverse of those induced by asphyxia, to which nitrous oxide unconsciousness has been attributed. Buxton considers its anæsthetic action due to its own inherent sedative virtues, and as far as asphyxia is concerned seems to have proved his position. The heart's action and blood-pressure are not much altered. The respiratory movements are primarily quickened, then slowed, and finally extinguished —probably by paralysis of the centre. The heart continues to beat for a short time after the stoppage of respiration. Certain peculiar phenomena are occasionally encountered, as muscular rigidity followed by flaccidity, loss of the superficial reflexes, persistence of knee-jerk, and less frequently involuntary evacuation of the bladder and rectum, and excitation of the sexual organs. It is well adapted to employment in the extraction of teeth, or, in short minor surgical operations, but its effects are too transient for the anæsthesia required in protracted operations. The amount necessary to produce anæsthesia (one or two gallons), as well as the complicated apparatus required for its administration, constitute also an objection to its general use. It is best administered from an India-rubber bag, containing about eight gallons of the gas, furnished with a mouth-piece with two valves, one of which is designed for the throwing out of the respired gas.

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* *Brit. Med. Journ.*, 1883, ii, 104.

† "Artificial Anæsthesia, etc.," 1881.

‡ *Transactions* of the Odontological Society of Great Britain, 1886–7, p. 90. On the Physiological Action of Nitrous Oxide Gas.

IV. **Ethyl Bromide**, (C_2H_5Br) is an anæsthetic which a few years ago bid fair to supersede ether and chloroform, but the occurrence of several fatal cases under its administration led to the abandonment of its use, and it is now seldom resorted to. Ott* states that it destroys life either when inhaled or administered subcutaneously, by a toxic action on the respiratory centre.

For the relief of pain during minor surgical operations, as the opening of *abscesses* or the extirpation of small tumors, *local anæsthesia* may be resorted to. This consists in congelation of the part by means of a *freezing mixture* (as ice and salt, which, when applied for three minutes to the integument, causes a thorough deadening of sensation in the superficial structures); or in spraying the part with some substance, as ether or ethyl bromide, which by its rapid evaporation produces the same effect; or the same purpose may be effected by the application of remedies like cocaine (*q. v.*), or carbolic acid (*q. v.*), which depress the sensory nerves of the part to which they are applied, and thus deaden sensation.

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* "Bromide of Ethyl; its Toxicological Action." I. Ott, pamphlet.

ORDER III.—ANTISPASMODICS.

Antispasmodics are medicines that allay irregular nervous action. Their effects upon the economy in a state of health are not very decided, and are limited to a slight stimulation of the circulation and exhilaration of the mental faculties. Their proper influence is, however, strikingly shown in certain deranged conditions of the nervous system, particularly those forms of spasm which depend upon idiopathic or primary nervous disorder, and are known under the designation of *hysteria*. They are also useful in many varieties of mental disturbance, as wakefulness, hypochondriasis, and even insanity, and are often preferable to narcotics in the treatment of these cases, from their comparative freedom of action on the brain. They are all distinguished by a powerful odor.

ASAFŒTIDA.—ASAFETIDA.

Asafetida is a GUM-RESIN obtained from the ROOT of Ferula Narthex and Ferula Scorodosma (*Nat. Ord.* Umbelliferæ), and is derived from Afghanistan. Though these are the sources given by the U. S. P., yet its exact commercial derivation has not yet been proven.* The plant has a long tapering root, the size of a man's leg, and an erect stem, from six to nine feet in height, rising from the midst of the leaves. The drug is obtained from incisions into the root, or by taking successive slices of it. The exuded juice is scraped off, hardened in the sun, and afterward packed for exportation. It occurs in masses of varying size, consistence, and color, but is usually whitish, intermixed with darker spots, and becomes reddish, and finally brown, by exposure to the air. It is sometimes soft and adhesive, at other times hard and brittle, and is not readily powdered except at a low temperature. It breaks with a waxy lustre, and the best samples appear to be composed of irregularly-shaped tears. Its taste is unpleasant, bitter, and acrid; its odor powerful, alliaceous, and fetid.

Asafetida is a *gum-resin* united to an alliaceous volatile oil. The gum is dissolved by water, and the mucilage thus formed suspends the resin and volatile oil. The resin and volatile oil are soluble in alcohol; but the tincture becomes milky on the addition of water, owing to the separation of the resin. The resin contains *ferulaic acid* ($C_{10}H_{10}O_4$) and *umbelliferon* ($C_9H_6O_3$), and, when fused with potassa, yields *resorcin.*

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* Pharmacographia, 2d ed., p. 314.

Physiological Effects.—Asafetida, when taken into the stomach, produces a local stimulant and carminative effect. After absorption, it proves a moderate excitant and exhilarant, and exerts a marked antispasmodic influence upon morbid conditions of the nervous system. Large doses cause nausea and vomiting. It also stimulates the mucous secretions generally, and increases the peristaltic action of the bowels, inducing soft, offensive stools. Its volatile oil is absorbed, and the odorous principle is recognized in the secretions, especially in the perspiration.

Medicinal Uses.—No medicine used to be more highly esteemed as an antispasmodic than asafetida, but it is now not often employed, because more efficacious and less disagreeable remedies have superseded it. It is resorted to in the various forms of *hysteria*, and is valuable in relieving the mental depression which constitutes one of the protean types of this disorder. In certain affections of the abdominal viscera, as *flatulent colic* and *costiveness*, asafetida is often useful as an atispasmodic and laxative enema. In flatulent colic occurring in children, the mixture in doses of fʒj will generally give speedy relief. In *tympanites*, especially in hysterical patients, or when accompanying constipation, nothing proves more serviceable than enemata of the mixture, or suppositories (containing the equivalent of ♏xl of the tincture). Enemata of the mixture have been used for the tympanites occurring in typhoid fever, but from the laxative effects of asafetida, turpentine is to be preferred in these cases.

Notwithstanding its disagreeable odor, this drug is largely used as a condiment in Asia; and even in the refined cookery of Europe its flavor is admired. Some persons take it habitually for its exhilarant effects; and, when used as a medicine, it generally becomes acceptable.

Administration.—Dose, gr. v to xx, in gelatin-capsules. It is most frequently given in the form of *mixture* (*mistura asafœtidæ*, —4 parts to water 100 parts)—dose f℥ss–j, repeated, or as an enema, f℥ij–iv. The mixture, from its whiteness and opacity, is sometimes called *lac asafœtidæ*, or *milk of asafetida*. *Pills of asafetida* are official, each pill containing gr. iij of the gum-resin. The *tincture* (20 parts to 100 of the tincture—dose, fʒj) is a good preparation, where the alcohol is not objectionable. A *plaster* is used externally in *whooping-cough* and *bronchitis;* it contains galbanum. *Pills of aloes and asafetida* and *mixture of magnesia and asafetida* (Dewees' carminative) are also official. The latter contains magnesium carbonate (5 parts), tincture of asafetida (7 parts), tincture of opium (1 part), sugar (10 parts), and distilled water (q. s. to make 100 parts); dose, fʒj–iv.

GALBANUM.

Galbanum is a GUM-RESIN obtained from Ferula galbaniflua and other species of Ferula (*Nat. Ord.* Umbelliferæ) which grows in Persia. It is met with in the form of tears, or more commonly in lumps, of a brownish color, and has a peculiar balsamic odor and a hot, bitter, acrid taste. It is a gum-resin united to a volatile oil. From the resin are obtained *umbelliferon* and *resorcin. Its effects* are similar to those of asafetida, but less active; and it is chiefly employed *externally*, for its rubefacient properties, as a stimulant. The *compound pills of galbanum* are used for antispasmodic and emmenagogue purposes; they contain galbanum, myrrh and asafetida, with a little syrup—dose, 3 to 5 pills. Galbanum forms the basis of the *galbanum-plaster*, which contains galbanum, turpentine, Burgundy pitch, and lead-plaster.

AMMONIACUM—AMMONIAC.

This is a spontaneous GUM-RESINOUS EXUDATION obtained from Dorema ammoniacum (*Nat. Ord.* Umbelliferæ), a plant of Persia. It comes in tears or lumps, of an irregular shape, yellowish on the outside, whitish within, is moderately hard and brittle, and has an unpleasant, bitter, and rather acrid taste, with a peculiar smell, somewhat like that of galbanum. It is a gum-resin, with a little volatile oil, the latter free from sulphur. *Resorcin*, but no umbelliferon, is obtained from the resin. *Its effects* are similar to those of asafetida; but it is seldom used except as an antispasmodic-expectorant in *chronic bronchitis.* Dose, gr. x to xxx. A *mixture*, 4 parts to water 100 parts, and *plaster* are official. The plaster is made with ammoniac and acetic acid. A *plaster of ammoniac with mercury* is also official.

CAMPHORA—CAMPHOR.

Camphor is a STEAROPTEN derived from Camphora Cinnamomum, the Camphor-Laurel (*Nat. Ord.* Lauraceæ), a large evergreen tree of China, Japan, and the island of Formosa. All parts of the tree are strongly impregnated with camphor, which is obtained from the chips of the roots and branches by subliming them with water and collecting the condensed camphor in pots. In this state it is known in commerce as *crude camphor*, and consists of dirty-grayish grains adhering in crumbling masses. *Japan* camphor, (called also *Dutch* camphor, because introduced to commerce from Nagasaki by the Dutch colonists), has a pinkish color and is purer though coarser than the *China* camphor. The crude camphor, as imported from Canton and Japan, is not found in the shops until it is purified by resublimation with quick-lime, when it is termed *refined camphor*. This occurs in large hemispherical or convex-concave cakes perforated in the middle. It is solid at ordinary temperatures, soft and somewhat tough, but may be readily powdered by the addition of a few drops of alcohol, chloroform, ether, or equal weight of sugar. It is translucent, has a strong, fragrant odor, and an aromatic, bitter, afterward cooling taste. It is volatile, highly inflammable, lighter than water, and very slightly soluble in it, but soluble in alcohol, ether, chloroform, oils and acids.

A valuable camphor* is known in the East, which is found in a concrete state in the cavities and fissures of the trunk of Dryobalanops Camphora (*Nat. Ord.* Dipterocarpaceæ), a tree of Borneo and Sumatra. By tapping the tree, or as a natural exudation, a camphor-oil is obtained (DeVriese *loc. sit.*), which must not be confounded with that of the laurel-camphor.

Camphor is $C_{10}H_{16}O$, and is chemically nearly related to the terpenes (turpentine). It forms substitution compounds with bromine, chlorine, and iodine, and yields an oil called *oil of camphor*, which drains away from the vats in the preparation of crude camphor. By passing hydrochloric acid into oil of turpentine, a substance is obtained called *artificial camphor*. Camphor heated with zinc chloride yields *cymol* ($C_{10}H_{14}$), and with nitric acid, *camphoric acid* ($C_{10}H_{16}O_4$), and *camphoronic acid* ($C_9H_{12}O_5$), the last two being oxidation products of camphor

INCOMPATIBLES.—Water precipitates camphor from the spirit of camphor.

AIDS.—The cerebral excitants, as cocaine, cannabis Indica, ether, chloroform and alcohol.

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* *Journ. of Pharmacy*, xii, p. 22. On the Camphor of Sumatra; De Vriese.

Physiological Effects.—The *topical* action of camphor is rubefacient and irrritant. After its absorption, its effects, in small doses, are moderately stimulant, exhilarant, and anodyne. In large doses, it causes considerable disorder of the cerebro-spinal system, depression of the circulation, and diaphoresis; and in excessive quantity it acts as a narcoto-irritant, occasioning burning heat in the stomach, violent cerebral convulsions, and maniacal delirium. No deaths from camphor, however, have been reported in healthy adults. In small doses, gr. v, owing no doubt to the stimulation of the circulation, it is aphrodisiac; in full doses, gr. xx, anaphrodisiac. Camphor is eliminated by the breath, skin, and urine, and it has been detected in the blood. In cases of poisoning, after evacuating the stomach, demulcents, opium and wine are to be administered.

Medicinal Uses.—From its combined antispasmodic and diaphoretic powers, camphor is a valuable remedy in the treatment of *acute dysentery* and in *cholera*, and is much employed in these diseases, either in combination with opium or as a substitute for the latter; ℞ Spiritûs camphoræ, tincturæ opii, āā ♏x. M. S.—Every 1 or 2 hours, in a little water. In the early stages of summer *diarrhœa* it is also frequently prescribed, and for this purpose the spirit may be given gtt. x–xx, and repeated p. r. n. with paregoric. As a diaphoretic stimulant and antispasmodic, it is useful in the low stages of *typhoid* and *typhus fevers*, and in *typhoid conditions* of the system generally. In many forms of mental disorder it calms irritability, relieves despondency, and induces sleep. And it is useful as an anodyne in allaying irritation or pain of the genito-urinary organs, as in *dysmenorrhœa*, uterine *after-pains*, *strangury*, and *nymphomania*. In *chordee* large doses are required—gr. x–xx. Milton * considers f℥ss–j of the spirit in water before retiring the best remedy for this complaint. He repeats the dose every time the patient awakes with chordee. On account of its pungency the administration of the fluid preparations of camphor is objectionable. Bumstead † gave it in pill, gr. iij–vj, at bed-hour, combined with opium. Camphoric acid ‡ (℥½ in 24 hours) has recently been shown to possess antisudorific properties against the sweating of *phthisis*. *Externally*, camphor is employed as an anodyne in *rheumatism*, and as a discutient in chronic inflammatory affections. Powdered camphor, sniffed into the nostrils, is a good remedy in *acute nasal catarrh*, *coryza* and *influenza*, or it may be volatilized in hot water and its fumes inhaled through a paper-funnel; it also enters into the composition of tooth-powders.

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* "On the Pathology and Treatment of Gonorrhœa," etc., 1887, p. 167.

† "Pathol. and Treat. of Venereal Diseases," 1883, p. 91.

‡ Bull. Gén. de Thérap., 1891, t. i. p. 14.

ADMINISTRATION.—The medium dose in substance is gr. v–x; but it may vary from gr. j to xx. It is best given in emulsion made by rubbing up the camphor with loaf-sugar, gum-arabic, myrrh and water. The form of pill is objectionable, from the difficulty with which it is dissolved in the gastric liquors.

Aqua Camphoræ (*Camphor-Water*). Dose, f℥j (containing about gr. ij) to f℥ij or iij. The *spirit* is used chiefly as an embrocation, but it may be given internally on a lump of sugar, where the action of alcohol is not objectionable, in the dose of gtt. v to fʒj—a serviceable remedy diluted with water to relieve *headache* where a gentle stimulant is indicated; and to check *hiccough*.

Hope's Camphor Mixture consists of camphor-water, f℥viij; nitrous acid, fʒj; laudanum, gtt. xxv; dose, f℥ss, repeated. This preparation is an efficient remedy in the treatment of *acute diarrhœa* and *dysentery*. It is not official.

Linimentum Camphoræ (*Camphor-Liniment*) consists of camphor (20 parts) dissolved in cotton-seed oil (80 parts); a mild embrocation.

Ceratum Camphoræ (*Camphor-Cerate*) is made by mixing camphor-liniment (3 parts) with olive-oil (12 parts), and incorporating the mixture with cerate (85 parts).

Linimentum Saponis (*Soap-Liniment*) is made by digesting soap and camphor with oil of rosemary in alcohol and water. It is a yellow oleaginous liquid, and is used as an anodyne and gentle rubefacient application in *gouty* and *rheumatic pains*, *chilblain*, *sprains*, *bruises*, *lumbago* and *myalgia*. It is useful to cleanse the skin in *stearrhœa*, and should be followed by an application of lime-water. It is also frequently combined with other liniments, as those of chloroform or ammonia.

Camphora Monobromata (*Monobromated Camphor*) is prepared by letting fall a stream of bromine upon powdered camphor till the latter is liquefied, then boiling the mixture in a water-bath, and afterward dissolving in alcohol and crystallizing. It occurs in long, colorless, acicular crystals ($C_{10}H_{15}OBr$), having an odor of camphor and turpentine and a slightly bitter taste, insoluble in water, but soluble in alcohol, the fixed and volatile oils, ether, carbon bisulphide, and chloroform. It is a substitution compound, one atom of bromine taking the place of an atom of hydrogen in laurel-camphor. It has been used in *delirium tremens* and *hysteria;* dose for an adult, gr. v, repeated.

VALERIANA—VALERIAN.

Valeriana officinalis, or Wild Valerian (*Nat. Ord.* Valerianaceæ), is a perennial European plant growing to the height of three or four feet. The RHIZOME and ROOTLETS are the portions used, and consist of numerous brown, slender, brittle fibres, attached to a rough, yellowish-brown, tuberculated head. When powdered, it is yellowish-gray. It has a peculiar, powerful odor, of which cats are fond, and a bitterish, sub-acrid, aromatic taste. Water and alcohol extract its virtues, which depend on the presence of a *volatile oil,* and a colorless volatile acid, called *valerianic,* may be separated either from the oil or root.

EFFECTS AND USES.—The effect of valerian on the nervous system is not constant, for it is sometimes excitant, and again calming. The hypodermic injection of valerian oil reduces the reflex excitability of the spinal cord, and antagonizes in frogs the tetanic spasms of strychnine. In medicinal doses, valerian improves digestion and appetite, decreasing the urinary flow and excretion of urea (Yvon [*]), hence it may prove serviceable in *diabetes insipidus.* Large doses occasion eructations, colic and diarrhœa, excitement of the circulation, diaphoresis, and increased urinary flow. It is much used as a nervous excitant and antispasmodic in the various forms of *hysteria* and *melancholia,* to control the active manifestations of which it may be prescribed with asafetida; ℞ Tincturæ valerianæ ammoniatæ, tincturæ asafœtidæ, āā fʒj. M. S. —One dose. Moral influence, however, in this unfortunate condition is mostly superior to medicine. Occasionally it is given in *hypochondriasis* and in *nervous headache.*

ADMINISTRATION.—*Dose* of the powder, from ʒss–jss, three or four times a day; of the *abstract,* gr. v–xv; of the *tincture* (20 per cent. in diluted alcohol), fʒj; of the *ammoniated tincture* (20 per cent. in aromatic spirit of ammonia—an excellent preparation), fʒj to ij; of the *fluid extract,* fʒj; of the *oil,* gtt. iv–v, taken dropped on sugar.

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[*] Arch. de Neurol. xix, 1890, p. 229.

Ammonii Valerianas (*Ammonium Valerianate*). — This salt, made by combining valerianic acid with ammonia, occurs in snow-white quadrangular plates, of an offensive odor like that of valerianic acid, and a sharp, sweetish taste. It deliquesces in a moist air, effloresces in a dry one, and is very soluble in both water and alcohol. Potassa and the mineral acids decompose it. It is much employed as an antineuralgic and antispasmodic in *neuralgia*, *nervous headache*, *hysteria*, *chorea* and *epilepsy*. Dose, gr. ij–viij, given in coated pills; or an elixir, prepared with aromatics,* may be used.

CYPRIPEDIUM.

The RHIZOME and ROOTLETS of Cypripedium pubescens and of Cypripedium parviflorum (*Nat. Ord.* Orchidaceæ), common indigenous plants, known under the names of *ladies' slipper* and *moccasin-plant*, are recognized by the U. S. Pharmacopœia.

The *dried root* is several inches long, bent, with a small, knotted, dark head, and numerous fibres of yellowish-brown color. It contains a *volatile oil*, *volatile acid*, and resin, and has been used as a substitute for valerian. Dose of the *fluid extract* (the only official preparation), ♏x–xx. The powdered root may be given in doses of gr. xv, three times a day. An infusion and tincture are also used; by precipitating the tincture with water, an oleo-resin is obtained, of which the dose is gr. ss–iij.

SCUTELLARIA.

The HERB of Scutellaria laterifolia, or Skullcap (*Nat. Ord.* Labiatæ), an indigenous perennial herb, found in moist localities, growing to the height of one or two feet, containing a crystalline bitter glucoside,† is considered by many American practitioners to possess valuable antispasmodic properties. A *fluid extract* is official. S. pilosoa and integrifolia possess a more bitter taste, and have been used as tonics.

The following vegetable substances, used as articles of diet, may be ranked also with antispasmodics :—

I. **Thea**—TEA (not official), the *dried leaves* of Thea chinensis

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* Take of ammonium valerianate, ʒj; fluid extract of vanilla, f℥ss; cd. tinct. of cardamom, fʒvj; curaçoa, fʒij; water, f℥iv; mix. Dose, a teaspoonful three times a day.

† Am. Journ. Pharm., Nov., 1889.

(*Nat. Ord.* Ternstromiaceæ), an evergreen shrub of China, India and Japan, whence the markets of the world are supplied. The most important constituents of tea are *essential* oil (upon which the flavor depends), *tannic acid*, an alkaloid termed *theine*, discovered by Oudry, in 1827—identical with caffeine, and *boheic acid.* According to Attfield * and others theine or caffeine is the alkaloid of tea, maté, guarana and kola-nut. Dr. Mays † found it to be analgesic, and he has employed it, gr. $\frac{1}{10}$–$\frac{1}{5}$, subcutaneously for the relief of *pain*, though his experience was not entirely confirmed by Castle.‡ A strong cup of tea is a good remedy for *headache.*

II. **Caffea**—COFFEE (not official) the SEED of Coffea arabica (*Nat. Ord.* Rubiaceæ), a small tree which is a native of southern Arabia and Abyssinia, and is cultivated in various tropical and semi-tropical countries. Coffee contains an alkaloid, *caffeine* ($C_8H_{10}N_4O_2.H_2O$) (which is *methy-theobromine*, isomeric with *theine*), and two peculiar principles, one resembling tannin, termed *caffeo-tannic acid*, and the other termed *caffeic acid.* The volatile oil, upon which the flavor depends, is developed by roasting. Coffee may be used for the general indications of antispasmodics, and is, besides, especially efficacious in relieving the sopor caused by opium-poisoning. Both tea and coffee lessen the urea in the urine. Coffee is relaxing, while tea is astringent, since it contains tannin. Salivary digestion is retarded by tea, § in part owing to its tannin; theine, caffeine or the volatile oil exert no action on it, while coffee and cocoa are indifferent. Gastric digestion is restrained by tea, coffee and cocoa, ranking in this order; on pancreatic digestion they exert no influence. This kind of inhibition is not abnormal, as it contributes to a beneficial end, slow being quite different from imperfect digestion.

Caffeina (*Caffeine*). Grains ¼–iij produce decided cerebral effects, as excitement, wakefulness and hallucination, and, when exhaustion sets in, sopor. It increases the number of the heart's beats, and raises the arterial pressure, both being followed by feeble action and diminished blood-pressure. In frogs the motor and probably the sensory nerves are affected by it. Injected into dogs and cats, it produces tetanus (Aubert). In cats * the increased flow of urine is coincident with dilatation of the blood-vessels, and it augments the volume of the kidneys. Applied to a cut-out muscle, it causes rigidity (coagulates the myosin) and abolishes the electrical contractility. Caffeine elevates and then lowers the animal temperature, and has decided diuretic powers (Gubler). Its efficacy in diminishing the *dropsy* of cardiac and other affections, by increasing the urinary flow, has recently been investigated by Stahl,† who reports favorable results from its employment. In man gr. vii–xij have caused decided cerebral effects, but no deaths have followed its use. *Caffeine* has been used as a cerebral stimulant in *nervous headache* (gr. j–ij), in *cardiac dropsy* (gr. v), being a powerful diuretic, and to antagonize *morphine narcotism*. Caffeine citrate is the salt most in use. Caffeine valerianate is useful in *hysterical vomiting*, in the dose of gr. j–ij repeated. None of the salts of this alkaloid are official.

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* "Chemistry, Gen., Med. and Pharm.," 10th ed., p. 398.

† *Medical News*, April, 1886.

‡ *Cinn. Lancet and Clinic*, Jan., 1886.

§ "Lectures on Dietetics and Dyspepsia," 1886, p. 28, *et al.* Wm. Roberts.

III. **Theobroma**—CHOCOLATE (noticed more at length under the head of demulcents—see *Oil of Theobroma*) contains a nitrogenous principle, *theobromine*, nearly identical in composition with caffeine ($C_7H_8N_4O_2$).

IV. **Erythroxylon**—COCA or CUCA.—The LEAVES of E. Coca (*Nat. Ord.* Erythroxylaceæ) have long been used as a masticatory by the Indians in Peru for the purpose of enabling them to undergo fatigue, hunger and thirst. An alkaloid termed *cocaine* ($C_{17}H_{21}NO_4$) has been found in coca, also *cocatannic acid*, which yields with the iron salts a green precipitate. Hydrochloric acid is also incompatible, as it splits cocaine into methylic alcohol, benzoic acid and *ecgonine*. The most interesting effects of coca in man are cerebral stimulation, lessening of the feeling of fatigue, the ability to remain for a long time without food, increased cardiac action and elevation of temperature. Coca ‡ lessens the excretion of urea and the urinary flow. Large doses cause muscular weakness, drowsiness and tinnitus aurium (Ott). Coca has been but little used in medicine, though its use is indicated in diseases requiring the checking of tissue waste, as *phthisis*. In cases of mental and physical fatigue dependent on overwork the wine or fluid extract repeated until the condition is relieved is a remedy of great value. The *fluid extract* is the best preparation; dose, f℥ss–ij.

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* *Journ. of Physiol.*, 1887, viii, p. 117. Experiments by Phillips and Bradford.

† " Inaug. Diss., Wurzburg, 1887.

‡ *Boston Med. and Surgical Journ.*, Sept. 7th, 1882. Mason.

V. **Cocaine** ($C_{17}H_{21}NO_4$).—This alkaloid has attracted much attention, recently, from its power of producing local anæsthesia, which property, though first discovered by Professor von Anrep,* of Charkov, did not attract general attention until the publication of a paper on the subject by Dr. Karl Koller, in September, 1884. The *hydrochlorate*, which is the salt in medicinal use, occurs in monoclinic prisms arranged in radial groups, soluble in alcohol and water. The free alkaloid is very unstable, contact with water being sufficient to decompose it. Neutral solution of the hydrochlorate will keep for some time undecomposed.

TEST.—The Cocaine salts can be distinguished from the other alkaloids by adding chlorine water (2–3 c. c.) and 2 or 3 drops of palladium chloride which throws down a fine red precipitate dissolved by sodium thiosulphate.

INCOMPATIBLES.—The alkaline hydrates and carbonates, and borax throw down white precipitates with solution of cocaine hydrochlorate. Boric acid added or as the menstruum prevents the decomposition with borax.

AIDS.—In its cerebral effects by alcohol and the cerebral stimulants, as cannabis Indica; its analgesic, by carbolic acid, opium and conium.

CONTRAINDICATIONS.—Being mostly eliminated by the kidneys chronic disease of these organs with obstruction of the urinary flow would be a reason for not giving cocaine in order to avoid toxic cumulative effects; also in cardiac weakness.

PHYSIOLOGICAL EFFECTS.—*A few drops of a four per cent. solution applied to the conjunctiva* rapidly produces anæsthesia of that membrane and cornea (lasting from 10 to 20 minutes), with contraction of the vessels and anemia of the membrane and dilated pupil,† preceded by slight contraction (which is gradual, the maximum being attained at the end of an hour); accommodation is said to be but little affected. Jackson affirms that cocaine influences unfavorably the nutrition of the cornea afterward. *Applied to the mucous membranes of the mouth, nose, larynx and trachea, urethra, vagina and*

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* *Pflüger's Archiv.*, 1879, XXI, p. 38.

† "The Influence of Cocaine on the Pupil and Cornea." By Edward Jackson, M.D. *Trans.* Coll. of Phys., 1887, p. 165.

rectum, it allays irritation, causes a superficial and temporary anæsthesia, at the same time lowering the sensibility of the deeper tissues, contracting the vessels, producing anemia of the surface (best seen in the vessels which ramify through the mucous membrane covering the turbinated bones in the nose), and lowering reflex sensibility of the part. It is not readily absorbed by the conjunctivæ unless used in excess; the Schneiderian membrane, however, takes it up rapidly so that its cerebral effects are soon obtained by this route. *Instilled into the external auditory meatus* it causes a superficial diminution of sensibility without affecting the hearing, and lowers the temperature of this region.

The account here given of the *internal* action of cocaine is based chiefly on Mosso's* elaborate investigations upon dogs, though its cerebral effects upon man will first be mentioned. Nervous system: in medicinal doses (in man) it stimulates the functional activity of the brain, the intellectual faculties becoming more active and imaginative, while the entire economy experiences a general feeling of renewed vigor. This state is succeeded by one of depression, and at the end by narcosis. Toxic amounts given to dogs induce symptoms of general paralysis, abolition of sensibility, cessation of reflex action, cardiac weakness and stoppage of respiration. The irritability of the sensory nerves is destroyed, and, according to Ott, that of the motor nerves is much depressed. Intravenous injections,† in dogs, caused general convulsions from irritation of the medulla, dyspnœa, reddening and swelling of the exposed brain, and diminution in the excitability of the psychomotor centres; the convulsive attacks were intermittent. Skeletal muscles: it induces, in full doses, muscular contractions of the trunk and extremities by excitement of the motor tracts of the cord, the cranial ganglia not being involved. Section of the cord between the occiput and atlas does not prevent this. A characteristic symptom of large doses is the production of sudden convulsions (not reflex) which resemble those of strychnia-poisoning. On the involuntary muscles cocaine sets up also contractions, and, if the dose be large enough, the urine and feces will be discharged involuntarily. According to Mosso the effects just noted are due altogether to an action on the nerve-centres, and not to one upon the muscle-substance, as is affirmed by Ott and others. Vulpian * found that cocaine caused wide pupillary dilatation. The patellar reflex is at first heightened and afterward abolished.

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* *Arch. für experiment. Pathol. u. Pharm.*, xviij, 1887, p. 153.

† Thèse pour le Doctorate en Médecine, Paris, 1887, par Y. Duchesne; and Lancet, London, Sept. 19, 1891.

CIRCULATION.—Cocaine increases the frequency and strength of the cardiac contractions, which are not dependent on paralysis of the vagi (Mosso). Anrep states, however, that the vagi are paralyzed, so that the matter cannot be considered as yet settled. A reduction of blood-pressure succeeds full doses, which is followed by a rise, apparently due to a direct action on the vessels. The heart continues to beat after breathing has ceased. It stops the frog's heart in systole. Medium doses exert no influence on the vaso-motor centre or tonicity of the vessels.

Respiration is increased, not by a reflex act, but by stimulation of the respiratory centre. A poisonous dose destroys life by paralysis of this centre.

TEMPERATURE.—Grains ij injected into the jugular vein of a dog caused the rectal temperature to advance about 1°, which in toxic amounts is followed by a fall.

SECRETIONS.—Vulpian (op. cit) could detect no increase in the hepatic, pancreatic, or salivary secretion, nor augmented flow through the ureters, but an augmentation in the sub-maxillary discharge was noted. As to the diuretic action of cocaine, Da Costa and C. B. Penrose † observed a decided increase in the quantity of urine and urates in nineteen out of twenty cases, with slight variations in sp. gr. They attributed its diuretic action to raised arterial tension. Elimination takes place, in part, by the kidneys, since it can be detected in the urine.

When taken in full or continued doses, anorexia, insomnia, debility and mental depression are the usual sequelæ, a group of phenomena that give evidence of the *cocaine-habit.* Cocaine induces increased metabolism throughout the economy as shown by elevated temperature, rapid pulse and tissue waste, with urates in the urine, these changes varying relatively with the amount ingested.

When administered *hypodermically* it causes no irritation. If the injection be made into the superficial tissues it acts as a local anæsthetic, while a deep injection produces a slight, transitory, general lowering of sensibility, a rise in temperature of from 0.5°–1.5° F., lasting several hours, dilated pupils with uncertain vision, and a stronger and fuller pulse, with increased power of the cardiac systole and lowering of the arterial tension.

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* Compt. Rendu, p. 836, 1884.

† The *Med. News,* June, 1886. Observations on the diuretic influence of cocaine. On the toxicology of cocaine, see *Med. and Surg. Reporter,* 1891; and Maryland, *Med. Journ.,* June, 1890, Mattison.

Toxicology.—Numerous fatal cases have been reported both by injection and per orem, in which the fatal quantity varied so widely that the lethal dose cannot be accurately stated. It may be well, however, to cite such cases as death from the urethral injection of fʒi of a 20 per cent., and fʒi of a 4 per cent., solution; moreover, gr. xxii and xx by the stomach have destroyed adult life. The largest non-fatal injected dose is gr. xix; the smallest fatal dose hypodermically is gtt. viij of a 4 per cent. solution. The autopsies showed congestion of the brain, lungs, liver and kidneys.

Antidotes.—The poisonous effects of cocaine are *antagonized* by chloroform and ether, which tend to arrest the tetanus of the respiratory muscles. Amyl nitrite also has been used successfully to antagonize toxic doses of cocaine. After the immediate danger is passed chloral should be given, and to restore the breathing, artificial respiration should be practiced.

Medicinal Uses.—It has been chiefly used *locally*, to prevent pain in operations on the eye, nose, larynx, vagina, rectum, etc. For this purpose the part is painted or sprayed with a 2–4 per cent. solution, and the application is renewed whenever the effect begins to wear off. In cases of *photophobia*, *earache*, *acute myringitis*, painful deglutition (from tubercular or cancerous deposits in the pharynx or larynx), in *vaginismus* (to relieve the pain in order that an examination may be made, or previous to the sexual act), and in spasm of the rectum or anus due to fissure, it may be used with great benefit. In *acute gonorrhœa*, fʒij of a 4–10 per cent. solution may be injected into the urethra, a few minutes before urination, to prevent pain during that act. In *irritable stricture*, or irritability with spasm of the sphincter vesicæ, a small gelatin-bougie, containing gr. ¼ of cocaine, has been passed down to the neck of the bladder and allowed to dissolve previous to a careful exploration of the urethra and bladder. A 20 per cent. solution has afforded relief in supra-orbital *neuralgia*, *pruritus ani*, and *scrotal eczema*, and it has been used for the relief of pain during the operation for *phimosis*. It has also been applied to painful *ulcers* and *felons*, either in powder or solution.

It is also recommended to produce contraction of the vessels and diminution of swelling in the mucous membrane of the nose and larynx, thus allowing the operator to obtain a better view of the parts during an operation, or as a means of preventing copious hemorrhage during operations on the nasal mucous membrane, or to check epistaxis.

Locally it has been applied, by brush or spray, to control *hay fever*, *acute nasal catarrh*, etc., and to lessen *cough* in laryngeal affections. Solution of cocaine hydrochlorate, 4–8 per cent., introduced within the nasal cavities by the atomizer is the best remedy to relieve temporarily the occlusion of the nasal fossæ in *acute* and *chronic nasal catarrh*. Collections of inspissated mucus should be first washed away with Dobell's solution. In an elaborate article by Hern[*] on the use of cocaine in dental surgery, the following conclusions are reached, viz., that it cannot be relied on for the relief of pain after extraction, or to deaden the sensibility of dentine, and as an analgesic to exposed pulps it is of doubtful utility. As a submucous injection for the purpose of extraction it is inferior to nitrous oxide gas (summary of 90 cases). He considers it chiefly useful in the opening of *abscesses*, in the manipulation of models and instruments, and in operations on teeth with acute periostitis. Darier[†] states that it dilates the pupil without paralysis of accommodation, and that it is quite equal to atropine for the purpose of examining the fundus oculi. It has been used *internally* in gastro-intestinal neuroses, as *gastrodynia*, etc., in doses of gr. $\frac{1}{8}$–$\frac{1}{4}$ once or twice a day, in pill; and as a cardiac tonic in *weak heart* and nervous *palpitation*. Prof. Da Costa[‡] has called attention to the successful use of cocaine hydrochlorate as a heart-sustaining agent in *low fevers*, especially where there is cerebral disturbance added. He gave gr. $\frac{1}{4}$–$\frac{1}{12}$ every two hours.

Hypodermically it has been used to relieve pain in severe *facial* and other *neuralgias*, in *acute pleurisy*, prior to the accumulation of fluid, and before the performance of minor surgical operations, as the opening of *abscesses*, inflamed *bursæ*, etc.

When used for these purposes the needle of the syringe should not be inserted deeply, since superficial injections accomplish the real object, viz.; local anæsthesia; when thrown in deeply there is no loss of sensation of the superficies (DaCosta*). Reclus,† basing his statement on 700 cases, directs as a matter of safety, the injections to be made slowly with gradual withdrawal of the syringe as the fluid is forced out. Dumont and Barton advise, when cocaine is injected into the limbs for local anæsthesia, the application of an Esmarch's bandage by the manipulating of which the medicament may be allowed to enter the circulation slowly. Deep injections have been especially recommended when it is desirable to obtain promptly the stimulating effects which the drug exerts over the heart, as in *collapse*, the early stages of *shock*, *weak heart* and *low fevers*.

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[*] *Trans.* of the Odontological Society of Great Britain, 1886–7, p. 218. Cocaine and its uses as a local anæsthetic in dental surgery.

[†] *Bulletin Gén. de Thérapeutique*, cvii. De l'emploi de cocaïne en Thérap. oculaire.

[‡] *Phila. Med. News*, Feb. 5th, 1887, p. 302.

Dose, internally, gr. ¼–ss; hypodermically, gr. ⅛–¼.

VI. GUARANA.—This occurs in chocolate-colored cylinders, which are worked up from the fruit of Paullinia sorbilis (*Nat. Ord.* Sapindaceæ), a plant of Brazil, where it is used to make a common and highly-esteemed beverage. It contains more *caffeine* than any other vegetable substance, and also a variety of tannic acid. It is recommended, medicinally, as a tonic, astringent, and antispasmodic, and has been found especially useful in *sick headache;* dose, ʒj-ij, or an alcoholic extract may be given in doses of gr. x–xx. A tincture and *fluid extract* may be used. The latter is official and can be given in doses of ♏ x–xx, or more.

VII. **Maté.**—Under this name the dried leaves of Ilex Paraguaiensis, a shrub of Paraguay, are extensively used in preparing a beverage throughout that region of country. *Paraguay tea*, as it is termed, has a balsamic odor and bitter taste, and contains a principle identical with *caffeine* and *theine*, and also *tannic acid.*

MOSCHUS—MUSK.

Class, Mammalia; Order, Ruminantia.

Musk is a peculiar DRIED SECRETION obtained from Moschus moschiferus, the Musk Deer, an animal rather larger than the goat, and resembling the deer in its characters, which inhabits the mountainous portions of central Asia. The musk-bag is found only in the male, and lies between the umbilicus and prepuce. It is an oval pod, about two and a half inches long and one and a half broad, flat on one side and convex and hairy on the other, and in a full-grown animal contains from ʒjss to ʒvj of a liquid secretion, which, when dried, is musk. Two kinds are known in commerce, the China and the Russia musk, the former of which is much the stronger.

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* *Trans.* Coll. of Physicians, 1886, 39. Hypodermic use of hydrochlorate of cocaine.

† Gazette Hebdom., Paris 25 sér., 1890, xxvii.

Musk occurs in grains or lumps concreted together, of a reddish-brown color, and has usually some hairs of the pod mixed with it. It has a powerful, diffusive, aromatic odor and a bitterish taste. It is inflammable, leaving a light spongy charcoal. On analysis, it yields *ammonia*, *fat*, *cholesterin*, *gelatinous* and *albuminous principles*, but the odorous principle has not been isolated. It is partially soluble in water and alcohol, and completely so in ether.

Owing to its high price, musk is greatly sophisticated. Sometimes artificial pods are met with, which may be distinguished from the genuine by the absence of the remains of the penis, and of an aperture in the middle of the hairy coat. The musk itself is more frequently adulterated by mixture with dried blood and a variety of substances. Indeed, little if any genuine musk is found in the shops.

Effects and Uses.—Musk is a powerful excitant and antispasmodic, without much effect on the cerebral functions. If a pure article could be obtained, it would have no superior as a direct antispasmodic in the treatment of essential nervous disorders—*hysteria*, *epilepsy* and *chorea*—and as a combined excitant and antispasmodic in the latter stages of *typhus* and *typhoid pneumonia*. But it is now little prescribed, owing to the difficulty of procuring it pure.

Administration.—It may be given in the form of bolus or emulsion. Dose, gr. x, to be repeated every two or three hours. A *tincture* is official; dose, fʒj.

An article termed Artificial Musk is made by the addition of one part of rectified oil of amber to three parts of nitric acid. It resembles musk both in sensible and medicinal properties, and it has been prescribed in its stead, in the same dose.

OLEUM SUCCINI—OIL OF AMBER.

Amber, Succinum, derived from an extinct coniferous tree, Pinitis succinifer, is a fossil-resin found in various parts of the world, and comes to this country from the shores of the Baltic. It is a hard, brittle substance, usually translucent, and of a pale golden-yellow color, insipid and inodorous except when heated. By distillation it yields an *oil*, OIL OF AMBER (*oleum succini*), which, when rectified, is employed medicinally. The oil, soluble in alcohol, is nearly colorless at first, but gradually becomes brown, has a strong peculiar odor, and a pungent acrid taste. An acid called *succinic* is also obtained from amber.

EFFECTS AND USES.—*Topically*, it is an active rubefacient. Oil of amber is excitant and antispasmodic, and has been used in *hysteria*, *epilepsy* and *hiccough*. It is chiefly employed as an external rubefacient application. Dose of the oil, gtt. v to xv, given in emulsion. For external use it may be mixed with three or four parts of olive-oil and brandy, with one part of laudanum added.

OLEUM ÆTHEREUM—ETHEREAL OIL.

This substance, known also as *oil of wine*, is made by the distillation of alcohol with a large excess of sulphuric acid; it is afterward mixed with an equal volume of stronger ether. It is a transparent, nearly colorless, volatile liquid, of a peculiar aromatic ethereal odor and sharp bitter taste, sparingly soluble in water, but readily dissolved by alcohol or ether. Specific gravity 0.910. It has antispasmodic properties, but is used in medicine only as an ingredient of the compound spirit of ether.

SPIRITUS ÆTHERIS COMPOSITUS—COMPOUND SPIRIT OF ETHER.

This preparation, known as *Hoffman's Anodyne*, is a solution of ethereal oil (3 parts) in stronger ether (30 parts) and alcohol (67 parts). It is a colorless, volatile, inflammable liquid, having an aromatic ethereal odor, and a burning, slightly sweetish taste. It becomes milky on being mixed with water, owing to the precipitation of the ethereal oil.

EFFECTS AND USES.—Hoffman's Anodyne has the antispasmodic and stimulant effects of ether, and derives additional tranquillizing and anodyne properties from the ethereal oil present; it is also an efficient carminative. It is much used in *hysteria*, and is often added to laudanum to prevent the nausea which the latter sometimes excites. A good fever and tranquillizing draught is ℞ Spiritûs ætheris compositi, fʒj; liquoris ammonii acetatis, tincturæ opii camphoratæ, āā f℥ss; aquæ, ad f℥jss. M. S.—One dose. Shake before using. Dose, fʒj-ij, in sweetened water.

ORDER IV.—TONICS.

Tonics, called also corroborants, are medicines which produce a gradual and permanent increase of nervous vigor. It is only, however, in certain conditions of disease that they manifest this invigorating influence; as, in a state of health, they often act as irritants or even nauseants. Their local effects are similar to their general effects. They exalt the nervous functions of the parts to which they are applied, and increase their firmness and density. When taken into the stomach they produce a twofold corroborant effect, improving the digestive powers by their local action, and strengthening the system generally by their cerebro-spinal influence. When given in very large doses, they produce nausea and vomiting, and when their administration is too long continued, they over-stimulate the gastric mucous follicles, causing a pathological secretion to be poured out, thus producing gastric catarrh. The after effect of tonics in large doses, especially of quinine, is one of depression upon the nervous centres.

Tonics differ from stimulants only in the more permanent character of their effects. The more powerful tonics are closely allied to the narcotics in their action, producing, in overdoses, giddiness, loss of sight and of hearing, convulsions, delirium, and even death. And this analogy is further illustrated by the curative power of tonics in the relief of painful and spasmodic diseases, as neuralgia, rheumatism, chorea, and epilepsy.

The articles of this class may be divided into *vegetable* and *mineral* tonics. The vegetable tonics are characterized by *bitterness;* and it is said that they owe their bitterness and medicinal activity to a principle which has been termed *bitter-extractive*, or by some writers *bitter-principle.* Tonics should be given before meals. The mineral tonics unite astringent with tonic properties; and the preparations of iron produce a further corroborant effect by increasing the red coloring matter of the blood.

THE THERAPEUTIC APPLICATION OF TONICS comprises a diversified range of diseases. They are employed as stomachics in *dyspepsia*, and as general corroborants in convalescence from acute diseases, in chronic affections accompanied by *marasmus* and *cachexia*, in *exhaustion* and *asthenia*, in *spinal irritation*, *hypochondriasis*, *spermatorrhœa*, *typhus* and *gangrene*, and in *typhoid conditions* of the system generally. But their most striking and valuable powers are shown in their febrifuge influence upon miasmatic diseases. The modus operandi here is obscure, but the curative powers are undoubted, and are generally attributed to their poisonous effects upon protoplasm, thus destroying the germs on which these diseases depend. The antineuralgic and antispasmodic properties of tonics have been already alluded to. They also enjoy considerable reputation in the treatment of chronic bowel-complaints, where they act by restoring tone to the debilitated intestinal tube; and, on the other hand, they are often useful as laxatives in torpid conditions of the alimentary canal.

VEGETABLE TONICS.

The vegetable tonics may be arranged into three sections, viz.: 1. THE PURE BITTERS. 2. THE AROMATIC BITTERS, which contain a stimulant volatile oil, and are aromatic as well as tonic. 3. THE ASTRINGENT BITTERS, which contain tannic and gallic acids, and are both astringent and tonic; this group contains cinchona, the most powerful and important of the vegetable tonics. The bitter-principle is also found in many medicines belonging to other classes, as rhubarb, aloes, taraxacum, etc, and imparts to them tonic properties.

SIMPLE BITTERS.

QUASSIA.

Quassia is the WOOD of Picræna excelsa (*Nat. Ord.* Simarubaceæ), a lofty tree of Jamaica and other West India islands. It is imported from the West Indies in billets of various sizes, which are found in the shops in the form of chips or raspings. It has no odor, but an intensely permanent bitter taste. Water and alcohol extract its virtues, which depend on a neutral bitter-principle termed *quassin* ($C_{10}H_{12}O_3$).

The article originally known as quassia was the root and wood of Quassia amara, a shrub of Surinam, but this does not now reach our markets.

EFFECTS AND USES.—Quassia is a mild tonic, free from irritant or astringent effects, and is employed principally in dyspepsia, want of appetite, and other stomachic affections. It promotes the appetite and digestion and causes a rapid development of strength. In *diarrhœa* from relaxation of the muscles, its use is of advantage. It increases* the saliva, milk, and secretions from the mucous membranes. It is much used to give additional bitterness to malt-liquors. It has proved a useful tonic in *asthenia*, *atonic dyspepsia*, *anorexia*, *chlorosis*, and lingering *convalescence* especially after fevers. Dose, in powder (rarely used), gr. xx to ℨj; but the best form of administration is that of infusion, in doses of f℥jss to iij; the infusion is a good remedy for thread-worms, given by enema. An *extract* (aqueous) is given in the dose of gr. v, but it is principally used as an excipient. A *fluid extract* is also official, dose ♏v–xx. Of the *tincture*, 100 parts contain 10 parts of the powder, the dose is fℨj to ij.

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* *Am. J. Phar.*, 1883, p. 472.

GENTIANA—GENTIAN.

Gentian is the ROOT of Gentiana lutea or Yellow Gentian (*Nat. Ord.* Gentianaceæ), a perennial plant of the mountainous parts of central and southern Europe, growing to the height of two or three feet, with broad, ovate, opposite leaves and handsome whorled yellow flowers. It is imported in cylindrical, branched, twisted pieces, of various sizes, marked by transverse annular wrinkles and longitudinal furrows. Its odor in the fresh state is peculiar and disagreeable, but, when dried, feeble; its taste is slightly sweetish and intensely bitter. Water and alcohol extract its virtues. It contains a *fixed oil*, an acid (*gentisin* or *gentisic acid*, $C_{14}H_{10}O_5$), pectin, grape-sugar, and a bitter-principle termed *gentiopicrin* ($C_{20}H_{30}O_{12}$), a glucoside, which is soluble in water and spirit of wine. Other species of gentian are employed as substitutes for the yellow gentian. The root contains no tannic matters (Maisch).

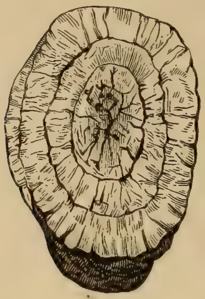
EFFECTS AND USES.—Gentian is a pure bitter, without either astringency or much aroma. In full doses it is more disposed to relax the bowels than the other simple bitters; and, like others of the vegetable tonics, in excessive doses it is capable of producing narcotic effects. It is an admirable stomachic in *anorexia*, in all kinds of *dyspepsia* and *convalescence*, and is also used in the various forms of constitutional *debility*. In gastric dyspepsia, due to deficiency in the quantity of the gastric juice, gentian combined with an alkali will relieve the condition. ℞ Tincturæ gentianæ compositæ, fℨj; liquoris potassæ, ♏xv. M. S.—In a wine-glass of water before meals.

ADMINISTRATION.—In the form of powder, rarely given on account of its bitterness, the dose is gr. x to ℨss. *Compound tincture* (*Tinctura gentianæ composita*, gentian 8 parts, bitter orange-peel 4 parts, cardamom 2 parts, to diluted alcohol enough to make the tincture weigh 100 parts), in the dose of fʒj to ij; *extract* (*aqueous*), in the dose of gr. x to ʒss; and *fluid extract*, in the dose of fʒss–j. Gentian is often well combined with other bitters, as columba, cinchona, and the alkalies.

CALUMBA.

Columba or Columbo is now generally ascribed by botanists to Jateorrhiza Calumba (*Nat. Ord.* Menispermaceæ), designated by some writers still under the old name of cocculus palmatus, a climbing plant of Mozambique, on the southeastern coast of Africa. The ROOT is the official portion, and is known in Africa under the name of *Calumb.* It consists of fleshy tubers, with numerous offsets, which are the portions used, the main root being too fibrous. They are found in the shops in thin, circular disks about 2 in. in diameter, externally of a brown, wrinkled appearance, and internally yellow.

FIG. 12.



JATEORRHIZA CALUMBA.

The odor is slightly aromatic, and the taste persistently bitter. Owing to the starch which is found in columbo, it is liable to be worm-eaten. It contains, besides a large proportion of starch, two bitter-principles, *colombin* ($C_{42}H_{44}O_{14}$) and *berberine* ($C_{20}H_{17}NO_4$ see p. 143), *columbic acid* ($C_{22}H_{24}O_7$), but no tannin. Water and alcohol take up its virtues; and from its liability to attract moisture from the air, it should not be kept in the form of powder.

EFFECTS AND USES.—Columbo is a very agreeable demulcent tonic, particularly acceptable to the stomach, and hence well adapted to the *convalescent* stages of acute disorders of the bowels and of *fevers* and to restore the appetite in *anorexia.* It is also a good preparation in the sickness of pregnant women, and is one of the best of the stomachics in all cases where there is unusual delicacy of the stomach. In its native country it is much employed in the treatment of dysentery.

Administration.—The dose of the powder is gr. x-xxx (rarely used). It may be given in the form of infusion (dose, fʒj to ij), which should be used at once, as it is liable to spoil. Of the *tincture* (10 parts to 100 parts of tincture) fʒj to iv may be given. Of the *fluid extract*, the dose is fʒss-j. Columbo is often combined with the aromatics, alkalies and iron, and is sometimes added to purgative mixtures.

Berberine ($C_{20}H_{17}NO_4$) (not official), the alkaloid found in columbo, is widely diffused in the vegetable kingdom, and is obtained from numerous plants of the natural orders *Berberaceæ*, *Menispermaceæ* and *Ranunculaceæ*, as barberry, yellow-root, hydrastis, goldthread and others It has been employed in the form of hydrochlorate and sulphate, as a tonic and febrifuge, in doses of gr. j-x.

CHIRATA.

Ophelia Chirata (*Nat. Ord.* Gentianaceæ), an East Indian plant, has been introduced into European and American practice under the name of Chirata, where it now ranks among the best simple bitters. The entire PLANT is official. Chirata contains a peculiar neutral bitter-principle, termed *chiratin* ($C_{26}H_{48}O_{15}$), and *ophelic acid* ($C_{13}H_{20}O_{10}$), which is amorphous; in medicinal properties it resembles gentian, and may be used in the same way, particularly in *anorexia* and *convalescence*. Dose, of the *fluid extract* ♏v-xx; of the *tincture* ♏v-fʒj.

AROMATIC BITTERS.

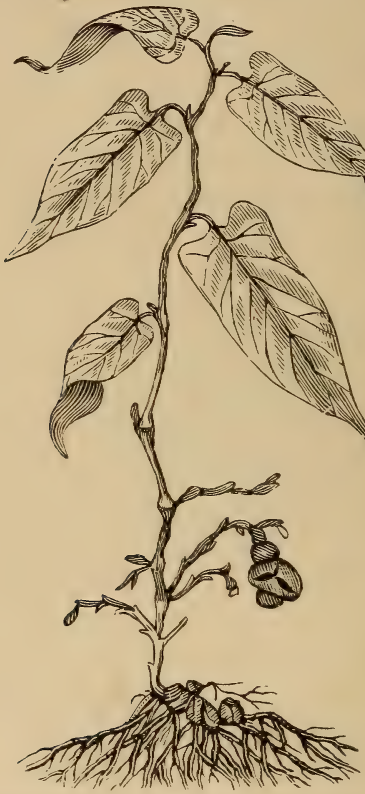
SERPENTARIA.

The RHIZOME and ROOTLETS of several species of Aristolochia are known under the name of Virginia Snakeroot. The most familiar is A. serpentaria (*Nat. Ord.* Aristolochiaceæ), an herbaceous, indigenous plant, with a perennial root, composed of numerous slender fibres, arising from a knotty, brown head. A. reticulata is a variety found in the southwestern States.

Virginia snakeroot is found in the shops in tufts of long, slender, matted fibres attached to a knotty, rugged head. They are brittle, and of a yellowish-brown color. The odor is aromatic and camphoraceous; the taste somewhat pungent, bitter and aromatic. Water and alcohol extract its virtues, which depend on the presence of *a volatile oil*, *a bitter-principle*, *resins* and *tannin*. The roots of A. reticulata are very commonly substituted for those of A. serpentaria, from which they differ only in the larger size of their fibres. They are quite equal to the latter, and are thought even to contain a larger proportion of volatile oil.

EFFECTS AND USES.—Virginia snakeroot is a combined stimulant and tonic, with diuretic or diaphoretic properties, according to the mode of its administration. In full doses it irritates the alimentary canal, causing nausea, eructations and colic. It is much used in the latter stages of *fevers*, and in other acute diseases, in *anorexia*, and is frequently combined with Peruvian bark in the treatment of *intermittents*. It may be administered in infusion (not official), dose f℥j to ij, repeated. Of the *tincture* (10 parts in 100 parts of tincture)

FIG. 13.



SERPENTARIA. RHIZOME AND ROOTLETS.

the dose is fʒj to ij; of the *fluid extract*, fʒss-j. *Huxham's Tincture* contains serpentaria.

EUCALYPTUS.

The LEAVES of the Eucalyptus globulus (*Nat. Ord.* Myrtaceæ), a lofty tree of Australia, commonly known as the Blue Gum-Tree, are classed among the aromatic bitters. The leaves should be collected from rather old trees. When fresh they are more active than when dried; their taste is aromatic and camphoraceous. They owe their activity to a *volatile oil*, having the odor of oil of peppermint, which contains *cymol* ($C_{10}H_{14}$), *two terpenes*, and *eucalyptol* ($C_{10}H_{18}O$); from eucalyptus are also obtained *tannin*, *resin* (crystallizable) and *cerylic alcohol.*

EFFECTS AND USES.—The oil possesses a decided destructive power upon infusoria, and *locally* is an irritant. Nervous system: large doses in animals produce muscular weakness, loss of reflex irritability, and finally death from centric paralysis (cord and medulla). These effects are preceded by a period of excitement. In small doses in man it causes mental activity and a feeling of well-being. The circulation and respiration are both accelerated by eucalyptus. Secretions: the ingestion of the drug augments the flow of saliva, promotes the appetite, causes diaphoresis, and, by stimulating the intestinal glands to activity, induces soft stools. It decidedly increases the elimination of urea (Gimbert). It is eliminated by the bronchial mucous membrane, kidneys and skin, imparting to the secretions of these organs the odor of the oil.

Eucalyptus has been given with contradictory results in miasmatic fevers, in doses varying from ʒj-iv of the dried leaves, or less of the fresh, but it is unlikely that it will ever supersede quinine as an antimiasmatic. The *fluid extract* is official; dose, fʒj in some aromatic water.

Oleum eucalypti (commonly called *eucalyptol*) has proved efficient in *bronchitis* and *whooping-cough;* dose, gtt. v-x in capsules or emulsion.

Eucalyptus may be used as a tonic in *gastric catarrh* and *dyspepsia*, and its employment in *chronic cystitis* is recommended. Indeed, its best effects are obtained in chronic affections of the mucous membranes, be they pulmonary, gastric, or vesical, and its beneficial influence in these diseases is due to contact of the oil during elimination with the surface. The growth of plantations of eucalyptus in miasmatic districts has been found to diminish the spread of malaria.

ANTHEMIS.

Anthemis nobilis, or Chamomile (*Nat. Ord.* Compositæ), is a small herbaceous, trailing European plant, cultivated extensively in both Europe and this country. The FLOWER-HEADS are the portions used. They consist of small spheroids, with convex yellow disks which contain the aromatic properties, and numerous white, spreading rays. Chamomile flowers have a bitter, aromatic taste, probably due to *anthemic acid*, and a strong, peculiar odor, both of which are imparted to water and alcohol. They contain a *volatile oil, bitter-principle*, a little tannic acid, and resin, but no alkaloid* has been obtained.

EFFECTS AND USES.—Chamomile, in small doses, is a mild, agreeable, aromatic tonic, and, in large doses, acts as an emetic. The cold infusion is much employed as a stomachic, in *dyspepsia* with flatulence, and the hot infusion is given to aid the operation of emetics. The flowers, boiled in water, form a good fomentation to inflamed parts. The usual form of administration is the infusion. Dose, as a stomachic, f℥ij, two or three times a day, cold; as an emetic, hot, *ad libitum.*

Matricaria. The FLOWER-HEADS of Matricaria chamomilla or German chamomile (*Nat. Ord.* Compositæ), an annual European plant, possess properties very similar to those of chamomile. They contain *volatile oil, bitter-extractive, tannin*, and *malates.* They are not much employed in this country.

EUPATORIUM.

Eupatorium perfoliatum, Boneset, or Thoroughwort (*Nat. Ord.* Compositæ), is a very common indigenous plant, growing in wet grounds in every part of the United States. It has numerous herbaceous stems, with long, narrow leaves, perforated by the stems. The LEAVES and FLOWERING TOPS are the official portion. They have a faint odor, a strongly bitter taste, impart their virtues to water or alcohol, and contain a bitter glucoside, called *eupatorin;* also *gum, tannic acid*, and a trace of *volatile oil.* In the leaves are found also *resin, wax*, and *gallic acid.*† E. teucrifolium, E. aromaticum, and other native species, are almost identical in their properties with E. perfoliatum.

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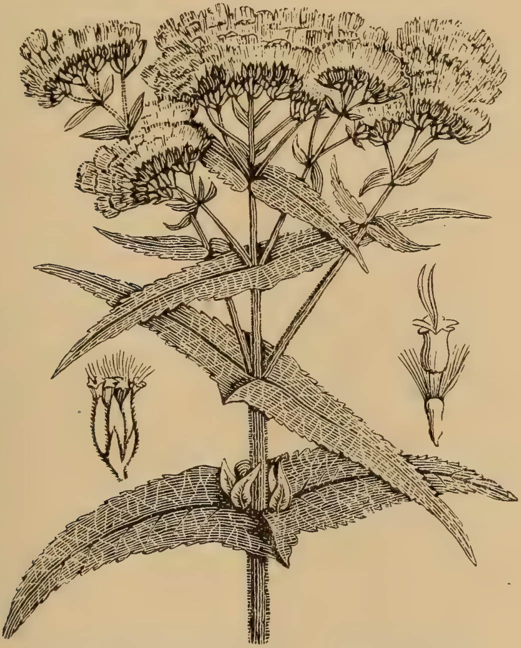
* *Am. J. Pharm.*, 1889, p.69.

† *Am. Journ. of Pharmacy*, F. W. Franz, Analysis of the Leaves of E. perfoliatum, Feb., 1888, p. 77.

Effects and Uses.—Thoroughwort is a stimulant tonic, diaphoretic and expectorant, and in large doses proves emetic and laxative. It is a good stomachic in *dyspepsia* and *anorexia*, and, from its combined corroborant, expectorant, and diaphoretic properties is an excellent remedy in epidemic *influenza*, and in the latter stages of *pneumonia* and *bronchitis*. It may be given in infusion, f℥ij of which may be taken cold, as a stomachic, three or four times a day, and in freer warm draughts as a diaphoretic; but the *fluid extract* is to be preferred; dose, f℥j.

FIG. 14.



EUPATORIUM PERFOLIATUM. FLOWERING TOPS.

ABSINTHIUM.

The tops and leaves of Artemisia Absinthium, or Wormwood (*Nat. Ord.* Compositæ), a European plant, naturalized in New England, are ranked among the aromatic bitters, but are not now much employed. They may be given in infusion.

Wormwood contains an *essential oil* (chiefly absinthol), a bitter-principle termed *absinthin* ($C_{40}H_{58}O_9$), *tannin*, etc. According to Magnan,[*] absinthe given to animals in small doses induces brisk muscular contractions, while large amounts provoke attacks in which the animal falls in tonic and clonic convulsions, with stertorous respiration, and involuntary fecal and urinary evacuation. The convulsions are not prevented by depriving the animal of its cerebral lobes. He points out, too, that absinthe epilepsy "is a kind of intoxication" to which is added the phenomenon of epilepsy. The oil possesses powerful stimulant properties, in large doses producing epileptiform convulsions, and in lethal quantities (f℥½) is capable of causing poisonous symptoms. No fatal cases, have, however, been recorded.[†] A *liqueur* termed *absinthe*, containing the oil in question, is much used in France, with highly pernicious effects. It enters into the composition of *vinum aromaticum*.

MAGNOLIA.

The BARKS of Magnolia glauca, Magnolia acuminata, and Magnolia tripetala (*Nat. Ord.* Magnoliaceæ), indigenous trees remarkable for the beauty of their foliage and the size and fragrance of their flowers, are official, and rank with the aromatic bitters. The barks (quilled, thin, and inodorous) of the trunk, branches and root, are alike official; but those of the last are the most active. They contain a *volatile oil*, *tannin*, *resins*, and a crystallizable *bitter-principle* (Lloyd[‡]). An extract of the fruit of M. umbrella yields *magnolin*. The aromatic property is impaired by drying, and is lost when the barks are long kept.

They are used as gentle stimulant tonics in *anorexia*, and diaphoretics in the low stages of *fever*, *rheumatism*, etc. An infusion may be given, but the best solvent is diluted alcohol.

CASCARILLA.

This is the BARK of Croton Eluteria (*Nat. Ord.* Euphorbiaceæ), a small tree of the Bahamas and other West India islands. It occurs in the form of small, thin, quilled pieces, though sometimes in fragments, having a grayish, easily detached corky layer and an inner smooth surface. Its taste is warm and bitter. It yields its properties to alcohol, and partially to water; and contains *volatile oil*, *resin*, a crystalline bitter-principle called *cascarillin*, and some *tannin*.

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[*] *Compt. Rendu*, 1869, p. 825.

[†] Woodman and Tidy, 1882, p. 268.

[‡] "Drugs and Medicines of North America," Nos. 1 and 2, 1886. See also *Am. J. of Pharm.*, Jan., 1889.

Effects and Uses.—Cascarilla is a very pleasant aromatic bitter, causing neither vomiting nor purging, and hence agreeing very well with the stomach. It may be given in powder in the dose of gr. xx to ʒss; but this is a less agreeable form than the infusion; dose, f℥ij; useful in *anorexia.*

ASTRINGENT BITTERS.

CINCHONA.

The name Cinchona (derived from the Countess of Chinchon, wife of a viceroy of Peru) is applied to the bark of different species of Cinchona (*Nat. Ord.* Rubiaceæ, Cinchoneæ), large trees which grow in the mountainous regions of the western portions of South America, from the 22nd° of south latitude to about the 10th° of north latitude. Two principal varieties of cinchona are known in commerce: Cinchona Flava (*Yellow Bark*), called in commerce *Calisaya Bark*, derived from Cinchona Calisaya; and Cinchona Rubra (*Red Bark*), derived from Cinchona succirubra. The Pharmacopœia now recognizes, however, as official the barks of all species of the genus Cinchona which contain at least three per cent. of the proper cinchona alkaloids. It acknowledges the following species, viz.: C. officinalis, C. micrantha, C. calisaya, and C. ovata.

Cinchona is brought to the United States from the Pacific ports of South America. It is obtained by stripping the trunks and branches of the Cinchona trees during the dry season, and is dried by exposure to the sun, during which process the smaller pieces usually become quilled.

1. The *Yellow* or *Calisaya Bark* comes both in quilled and flat pieces. The former are from three or four inches to a foot and a half long, from a quarter of an inch to two or three inches in diameter, and of variable thickness. They have a brownish epidermis (with longitudinal wrinkles and transverse fissures), which possesses none of the virtues of the bark. The bark itself is one or two lines thick, compact, of a short, fibrous texture, and when broken presents shining points. The flat pieces, which are derived from the larger branches and trunk, are usually destitute of epidermis, are more roughly marked externally, and are of a browner hue than the quilled pieces. They are also less compact, less bitter, and of less medicinal

virtue. The yellow bark is distinguished from the other barks by its much more bitter taste; its comparative freedom from astringency; its brownish-yellow, somewhat orange color, which is still brighter in the powder; and by *containing a large proportion of quinine with very little cinchonine.*

2. The *Red Bark* usually comes in large, thick, flat pieces; sometimes also in quills from half an inch to two inches in diameter. They are covered with a reddish-brown, rugged epidermis, beneath which is a dark-red, brittle and compact layer, the interior parts being woody and fibrous and of a lively brownish-red color. The taste of red bark is bitter and astringent; its odor not different from that of the other barks; its powder is reddish. *It contains considerable quantities both of quinine and cinchonine.*

Pale Bark, called in commerce *Loxa* and *Lima Bark*, derived from C. condaminea and C. micrantha is no longer official. It comes in thin quills of a pale fawn-color. The pale barks *contain a much larger proportion of cinchonine than of quinine;* and, from their yielding little of the latter alkaloid, have fallen into disuse in the United States.

Under the name of CARTHAGENA BARKS, large quantities of very good bark have been imported from New Granada, and are now used in the manufacture of quinine, under the name of Colombian barks. Their percentage of alkaloids varies greatly.

Within a few years, the cultivation of several varieties of cinchona trees has been successfully introduced into India, the islands Ceylon and Java, and also into Jamaica, and the markets are now supplied with barks of very good quality from these sources.

CHEMICAL CONSTITUENTS AND TESTS.—The most important constituents of cinchona are two alkaloid-principles, termed QUININA (*Quinine*) and CINCHONINA (*Cinchonine*), which exist chiefly in combination with an acid called *kinic* (inert). These alkaloids are found in different proportions in the different barks, quinine being obtained from the *yellow* bark most abundantly, cinchonine from the *pale* bark, and the two principles in about equal proportions from the *red* bark. Two other valuable alkaloids, *quinidine* and *cinchonidine*, are found (also as *kinates*) most abundantly in the *pale* and *Carthagena* barks, but to a certain extent in all; also the alkaloids, aricine, paricine, quinamine, and paytine, have been discovered in cinchona. Other principles found are *cincho-tannic acid*, coloring matter, *kinovic acid*, starch, fatty matter, and a trace of volatile oil. Gum is found in the pale bark, but not in the yellow or red bark. By heat, the crystallizable alkaloids are converted into amorphous modifications, as quinine into quinicine and cinchonine into cinchonicine

Quinine is obtained by heating the sulphate with an alkaline solution. QUININÆ SULPHAS (*Quinine Sulphate*) is prepared in the following manner: Powdered yellow bark is boiled in water acidulated with hydrochloric acid, by which the alkaloid is separated from its combination with kinic and other acids, to form a soluble hydrochlorate. By the addition of lime, this salt is decomposed, and quinine precipitated. The precipitate is washed with distilled water, and is separated from insoluble impurities by digestion in boiling alcohol, which is afterward distilled off. To the residual brown viscid mass, mixed with distilled water and heated to the boiling point, sulphuric acid is added, in quantity sufficient to dissolve the quinine. The liquor is then boiled with animal charcoal, filtered, and set aside to crystallize. Modern methods of manufacture have much cheapened quinine, benzoated amylic alcohol being employed to exhaust the bark. The alkaloid quinine may be obtained in the form of fine crystalline needles of a silky lustre, but usually occurs as a loose white powder; it is inodorous, very bitter, and alkaline. It (the hydrate) is soluble in 1670 parts of cold water, and in 773 parts of boiling water, in little more than its weight of alsolute alcohol, in about 5 parts of chloroform, and in 25 parts of ether, and also in the fixed and volatile oils. It unites with acids to form salts, the most important of which is the official salt, the sulphate. Its composition is $C_{20}H_{24}N_2O_2 \cdot 3H_2O$. Quinine and its salts may be distinguished from all other vegetable alkalies and their salts (excepting quinidine and quinicine) by forming an emerald-green precipitate when treated first with fresh chlorine-water and then with ammonia (Thalleioquin test, detects $\frac{1}{5000}$ part, Flückiger). *Herapath's* test is made by adding to quinine sulphate (gr. v) diluted acetic acid (f℥j) with alcohol (f℥ss) and tincture of iodine (8 drops), heating gently over a spirit-lamp till it forms a clear light-brown solution, when, as the liquor cools, right-angled, quadrate, rhombic crystals are deposited, which by reflected light appear of a copper-green color, resembling the elytra of Spanish flies. This precipitate, which is quinine iodosulphate ($C_{20}H_{24}N_2O_2SO_4H_2I_2$), is termed *Herapathite*. *Cinchonine* is a white crystalline substance, less bitter than quinine, almost insoluble in cold water, very soluble in boiling alcohol, and slightly soluble in ether and the fixed and volatile oils. Its composition is $C_{20}H_{24}N_2O$. It is distinguished from quinine by striking a white precipitate when chlorine-water and afterward ammonia are added; with potassium ferrocyanide, a yellowish-white precipitate falls. As cinchonine is but slightly soluble in ether, while quinine is soluble in that menstruum, the latter may by this means be readily separated from the former alkaloid. The medicinal properties of quinine and cinchonine are analogous, and cinchonine sulphate is now official. *Quinidine* is isomeric with quinine, but more crystallizable and less soluble in ether; its salts strike a white precipitate with solution of potassium iodide. *Cinchonidine* is isomeric with cinchonine. It is usually found mixed with quinidine the mixture being known as *commercial quinidine*. The commercial quinidine sulphate (which is more soluble in water and alcohol than quinine sulphate) may be used as a substitute for the latter salt.

INCOMPATIBLES.—The alkalies and alkaline earths precipitate the alkaloidal principles of cinchona; tannic acid, and the tincture and compound solution of iodine, form with them insoluble compounds; the ferric salts precipitate cincho-tannic acid; solution of potassium arsenite is also incompatible with infusions and decoctions of cinchona, as it forms a precipitate with them.

AIDS.—As a tonic such bitters as gentian, quassia, serpentaria, and nux vomica. Its antipyretic effect is enhanced by antipyrine, antifebrin, resorcin, and salicylic acid. As an antiperiodic eucalyptus, carbolic acid, creasote, arsenic, though for this effect it is best given alone. Aconite increases its sedative cardiac influence.

PHYSIOLOGICAL EFFECTS.—*Locally*, cinchona and its alkaloids act as irritants, and possess, besides, a marked antiseptic power, arresting putrefaction and fermentation by a destructive influence upon fungi and infusoria.* As the physiological action of cinchona depends on its contained alkaloids (chiefly quinine), the following account relates to the latter. Nervous system: quinine in medicinal doses stimulates the cerebral functions and increases the mental activity. Full doses (gr. xv–xx) induce a hyperemic condition of the brain, the first indications of which are felt by the special senses, especially that of hearing, which undergoes subjective noises, as ringing and roaring in the ears (*tinnitus aurium*), with partial deafness, the latter rarely permanent; amblyopia is an accompaniment, though less common. Doses of this size, continued, may produce a sense of fullness of the head, frontal headache and vertigo. Very large doses augment the above symptoms, which are accompanied by a slow, weak pulse, dilatation of the pupils, convulsions and stupor; death in rare cases has followed quinine-poisoning, though immense doses of it have been taken with impunity. Quinine given to frogs reduces and finally abolishes the reflex excitability of the spinal cord. Its effect in this respect, on man, is as yet *sub judice*. When taken in doses of gr. x–xx, during labor, it energizes the uterine contractions. Circulation: in small doses quinine slightly accelerates the action of the heart; while large amounts (gr. xl–lx) decidedly retard its beats and force, and sometimes cause it to intermit, especially in children. This retardation occurs after section of the vagi, indicating a direct influence on its motor ganglia; applied in solution to the cut-out heart it quickly stops its movements. The cinchona alkaloids are readily dissolved from the bark by contact with the gastric juice, and being diffusible and crystalline, quickly osmose into the blood; if, however, from any cause, they pass into the small intestines, contact there with the alkaline fluids of that tube will precipitate them, and they will be discharged with the feces. Upon the blood, quinine has several marked actions, as follows: both in health and inflammation it diminishes the number of white corpuscles, and retards their amœboid movements (Binz); Schwalbe's investigations, however, do not confirm those of Binz; it hinders the carrying of oxygen to the tissues, and increases the proportion of red to white corpuscles (Cutler and Bradford). The absorption of quinine by the blood is aided by the carbon dioxide gas of that fluid. It is unknown how it exists there. The production of acid in freshly-drawn blood is diminished by the addition of quinine-solution (Binz). Temperature: in small doses in health no influence upon the animal heat has been noted; but in large amounts a moderate fall takes place (about ½° F.). No complete explanation has as yet been given of this action, but it seems to be due to an interference with the oxidation-processes in every part of the body. Secretions: cinchona stimulates the peptic glands, increasing their secretion and consequently the appetite and digestion, and, from the tannic acid which it contains, produces a slightly astringent effect not belonging to the salts of its alkaloids. If given too long, or if the stomach and bowels are in an irritable condition, it is soon apt to produce nausea, vomiting, and even diarrhœa. Occasionally quinine causes a cutaneous eruption, as erythema, herpes, etc. A rarer effect is renal and cystic irritation. Quinine, it is said, causes contraction of the spleen (Piorry); this, however, has been denied. Large doses of quinine (gr. xxv–xl) decidedly diminish the amount of urea and uric acid in the urine, also the phosphoric acid. Elimination*: quinine is eliminated chiefly by the kidneys, and it has been found in the urine twenty minutes after the subcutaneous injection of a large dose. According to Thau from ½ to ⅓ escapes in the first six hours. It is discharged partly as quinine and partly as isomeric modifications (quinicine).

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* *Arch. de Physiol. Norm. et Pathol.*, v, 1873, p. 389. L'ăction de la quinine sur les vibrioniens et sur les mouvements amiboïdes; par Bochefontaine.

Medicinal Uses.—Though the medicinal value of cinchona, or its alkaloid, quinine, can scarcely be over-estimated in the treatment of various diseases, yet its chief therapeutic applications may be divided into three classes, in the following order of merit: 1. Antiperiodic; 2. Antipyretic; 3. Tonic. The most important therapeutic employment of cinchona is as an antiperiodic in the treatment of fevers of a miasmatic origin. Its efficacy in these diseases was first made known to the world by the Jesuit missionaries in Peru, from whom it was called *Jesuit's powder.* As cinchona itself is now rarely administered internally, the following remarks apply to its alkaloids, on the presence of which its powers depend. The type of miasmatic fever in which the effects of quinine are most strikingly displayed is *intermittent*, the non-pernicious and uncomplicated forms of which it rarely, if ever, fails to control. It may be given in these cases from the very onset of the attack; and if, owing to gastric irritability, it is rejected by the stomach, it should be introduced by the rectum or by hypodermic injection. In *remittent fevers*, quinine is scarcely less useful than in *intermittents;* and most physicians who practice in miasmatic districts now concur in recommending its early exhibition in these fevers, without waiting for a remission. In either disease the best time, as a rule, for its administration, since the major portion is eliminated in the first six hours, is from four to six hours preceding the expected paroxysm, and should it be desirable to get its effects quickly, on an empty stomach and in solution. If the onset be accompanied by violent headache and bounding pulse morphia subcutaneously and tincture of aconite should be given with it. In the *pernicious* or *congestive* forms of intermittent and remittent fevers, the early administration of large doses of quinine or cinchonine, in combination with stimulants, is imperatively demanded; and the hypodermic injections of quinine sulphate (gr. iij–v) may even be necessary. As a prophylactic against miasmatic fever and in the *malarial cachexia*, the use of the preparations of cinchona is very efficacious. We now seem to be approaching an explanation as to the exciting cause of miasmatic fevers and the specific action of quinine against them, due to the researches of Marchiafava[*] and Celli on the plasmodium malariæ; of Laveran,[†] on the microbes found by him in the blood; of Councilman and Abbott,[‡] on certain hyaline bodies discovered by them also in the blood; and, lastly, to Osler,[§] on the hæmatomonas malariæ. These observers, with singular unanimity, have found certain microbes in the blood of persons suffering with miasmatic fever, the vitality of which was destroyed by quinine. But it is yet too soon to formulate a positive theory which will surely connect the presence of these microbes with an attack of ague and the destructive action of quinine upon them. The *antipyretic* power which the quinine salts possess renders their use extremely valuable in conditions of *fever*. In such states quinine is best given in a single large dose (ʒss to ʒj), and since the elimination of the major portion of it takes place in the first six hours, it may be necessary to repeat this dose at the expiration of that time, if it be desirable to sustain its antipyretic effect. In Germany, the treatment of *typhoid fever* with large doses of quinine, gr. xx to xl, given in the evening, is in vogue. On account of the cardiac weakness, anorexia, and nervous depression produced by the salts of quinine, they should not be given in large doses in *pneumonia*.[‖] In *erysipelas*, the author has found quinine sulphate scarcely, if at all, less efficient than in miasmatic fevers, and it should be given gr. iij–v, t. d., frequently combined with large doses of iron (*q. v.*). In *puerperal septicemia*, quinine may be given as an antipyretic in addition to antiseptic, uterine and vaginal injections, with digitalis, as indicated, and opium, stimulants and easily assimilated food. In the treatment of *after-pains*, when opium has failed, quinine in doses of gr. x bis die., often gives relief. In all conditions of hyperpyrexia, as in *acute rheumatism*, the exanthemata and *pyemia*, it is still employed, although the phenol-derivatives (*e. g.* antipyrine), are superseding it to reduce temperature. As a general *tonic* and stomachic in *anorexia*, *asthenia*, and *neurasthenia*, cinchona and its alkaloids are also much used, but where gastric susceptibility exists, some of the simple bitters may be preferable. In *convalescence* from acute diseases, as the continued and eruptive fevers, in the hectic of *phthisis*, and in *typhoid conditions* generally, it is constantly prescribed. In the various *neuralgiæ*, a large dose of quinine combined with morphine or belladonna, or smaller doses with arsenic and iron, form an effective plan of treatment. By its contracting action on the gravid uterus, quinine sulphate exerts an influence in promoting normal *labor*, and will often prove useful in counteracting inertia of the uterus in parturition. A full dose of quinine will sometimes abort an impending paroxysm of *asthma.* In surgical *shock*, as after grave operations, the administration of quinine is of the greatest utility. There are many other maladies, besides, in which cinchona or its alkaloids render important aid, as to combat the fever and bone-pains of *dengue* obstinate though they be; in *pericarditis* before marked effusion has taken place; as a tonic in *emphysema*, *influenza* and *hay-fever;* to relieve *headache* (browache); and in the management of *exophthalmic goitre*, *purpura* and *yellow fever.* In acute inflammations, if the researches of Binz be correct, quinine in the first stage is the remedy to be employed in order to prevent the exudation of leucocytes, and for this object about gr. ¼ to each pound of the patient's weight will be needed. The systemic effects of quinine may be obtained by introducing it within the rectum in suppository or enema; but it is advisable only to so use it when its administration by the mouth is contraindicated. *Topically*, cinchona is employed as an astringent and antiseptic. A lotion of quinine sulphate is used in *alopecia.*

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* *Bull. Gén. de Thérap.*, t. xci. Rienzi.

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[*] Bull. d. r. Accad. Med. di Roma, 1886, xii, 19–22. Marchiafava E. Richerche sull'. infezione malaria.

[†] Traité des Fièvres Palustres, par A. Laveran, 1884, p. 448.

[‡] *Am. J. M. S.*, April, 1884, p. 416.

[§] *Brit. Med. Jour.*, March 12th, 1887, p. 556.

[‖] *N. Y. Med. Rec.*, Jan. 29th, 1887. Discussion on the use of quinine in pneumonia; N. Y. Academy of Medicine.

Administration.—The use of cinchona in powder has been almost abandoned, owing to its bulk and disagreeable taste. When exhibited in this form ℥ss to jss is the dose as an *antiperiodic* given usually in divided amounts; as a tonic, ʒj. The following official preparations are employed: *infusion* (6 parts of the powder to water 100 parts, to which aromatic sulphuric acid 1 part is added), dose, f℥ij, repeated; *extract* (of yellow bark), dose, gr. x–xxx, equivalent to ʒj of bark; *fluid extract* (yellow), dose, fʒj, equal to ʒj of bark; *tincture* (20 parts yellow bark to a mixture of 10 parts of glycerin with sufficient alcohol and water to make 100 parts of the tincture), dose, fʒj–iv; *compound tincture* [*Huxham's*] (containing red bark 10, bitter orange-peel 8, serpentaria 2, glycerin 10, alcohol and water to make 100 parts of tincture), dose, fʒj–iv. In prescribing bark, opium or port wine is often given with it, when it acts on the bowels. It is also occasionally combined with serpentaria, and when the stomach will not retain it, it may be administered by the rectum, or even the *hypodermic exhibition* of the *quinine sulphate* may be resorted to. When administered subcutaneously the danger of the formation of a small abscess at the seat of introduction must not be lost sight of, and a salt soluble in water should be selected, as the bisulphate, the solubility of which may be increased by the addition of tartaric acid.

Quininæ Sulphas (*Quinine Sulphate*). This salt is prepared by the process described at p. 151. It occurs in fine, silky, rather flexible needle-shaped crystals (interlaced among one another, or grouped in small star-like tufts), which are odorless, very bitter, and slightly efflorescent. It is soluble in 740 parts of cold and 30 parts of boiling water, readily soluble in alcohol, but insoluble in ether. Quinine is a ternary base, and forms, with sulphuric acid, a *basic*, *normal* and *acid sulphate*. *Basic quinine sulphate*, $2(C_{20}H_{24}N_2O_2)SO_4H_2 + 7$ aq., is the salt in common use. By the addition of dilute sulphuric acid to the basic salt *normal quinine sulphate* ($C_{20}H_{24}N_4O_2.SO_4H_2 + 7$ aq.) is obtained in four-sided prisms, which are soluble in 11 parts of cold water. *Acid quinine sulphate* ($C_{20}H_{24}N_2O_2.2SO_4H_2 + 7$ aq.) occurs as white prisms, freely soluble in water. Solutions of quinine and its salts possess the property of fluorescence and left rotary power on polarized light. Various substances are mixed as adulterations with quinine sulphate. They may be detected by adverting to their relative solubility in different menstrua, as compared with the sulphate, or by chemical tests. Thus, gum and starch are left behind by alcohol; salicin becomes red on contact with sulphuric acid, etc.

Incompatibles.—Quinine sulphate is decomposed by the alkalies, their carbonates and the alkaline earths. With the alkaline acetates and Basham's mixture quinine acetate is formed sparingly soluble. In solution it forms white precipitates with liquor potassæ, sodæ, and aqua ammoniæ. The tannic acid of astringent infusions throws down a white compound, and the soluble lead salts, oxalic, tartaric and gallic acids yield a precipitate with it; with compound solutions of iodine, quinine iodide is formed.

Effects and Uses.—The effects of quinine sulphate on the system are the same as those of cinchona, and, from its being less apt to disagree with the stomach, it has almost superseded the use of the latter. See p. 152.

Administration.—The ordinary dose of the *quinine sulphate*,* is as an *antipyretic* gr. x–xx, repeated as indicated, as an *antiperiodic*, gr. xvj, equal to about ℥j of bark, but as much as gr. xx, and even more, are often required; as a general *tonic*, gr. j–vj. It may be given dissolved in some aromatic water, by the aid of aromatic sulphuric acid, also as an enema, or hypodermically. (Glycerin is a good excipient for pills of quinine sulphate.) *Saccharin* will partly disguise the bitterness of quinine. ℞ Quininæ sulphatis, gr. j; saccharin, gr. v; aquæ, f℥j ½. M. S.—Shake.

Quininæ Bisulphas (*Quinine Bisulphate*), the normal quinine sulphate, is preferred only on account of its greater solubility (1 part to 11 of water), as it contains about one-third less of anhydrous quinine than the basic sulphate. (See foot-note.) It may be given in the same doses as the ordinary sulphate.

Many other salts of quinine have been introduced into practice, but few possess any advantage over the sulphate and bisulphate.

Quininæ Valerianas (*Quinine Valerianate*) is obtained by dissolving freshly precipitated quinine in diluted valerianic acid. It occurs in transparent or white rhomboidal tables, of the peculiar repulsive odor of valerianic acid, and an acrid bitter taste, soluble in alcohol and ether, and soluble in water (1 to 100). It fulfills the indications of quinine and valerianic acid, and is therefore especially useful in nervous disorders. Dose, gr. j. to xx. *Quinine hydrobromate* is official, and being soluble in 16 parts of water, is recommended also for hypodermic use (Gubler). *Quinine hydrochlorate* is also official; it is soluble in water 1 to 34 parts.

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* Therapeutical equivalents of the salts of quinine, by M. Boymond. *Bull. Gén. de Thérap.*, Avril 15ième, 1887, p. 311.

1.34 gramme of the basic sulphate = 1 gramme of anhydrous quinine.
1.31 " " valerianate = " " "
1.22 " " hydrochlorate = " " "
1.30 " " hydrobromate = " " "
1.69 " " bisulphate = " " "

Others also are given.

Quinine sulphovinate, from its ready solubility, dissolving in twice its weight of water is well adapted to hypodermic injection.

Quinine carbolate, citrate, phosphate, salicylate, and sulphocarbolate have all been used of late.

Crude quinine is the impure quinine obtained from the manufacturer before separation from the insoluble impurities. It is a soft solid of resinous aspect, nearly free from bitterness, and may be given to children in the same doses as the sulphate.

Chinoidinum (*Chinoidin, quinoidin*) is a "mixture of alkaloids, mostly amorphous, obtained as a by-product in the manufacture of the crystallizable alkaloids from cinchona." (U. S. P.) It appears as a resinous mass, variable in quality, faintly bitter, of a brownish color, soluble in dilute sulphuric acid and alcohol, and, according to Liebig, bears the same relation to ordinary quinine that uncrystallizable sugar bears to the crystallizable. It is considered equally efficacious with quinine, but requires doses rather larger than quinine sulphate, than which it is much more economical.

Cinchoninæ Sulphas (*Cinchonine Sulphate*) is made from the mother-water remaining after the crystallization of quinine sulphate. Being the most soluble of the phosphates of the four alkaloids found in bark, it remains in solution after the quinine sulphate and the mixed cinchonidine and quinidine sulphate have crystallized out. From the mother-water it is precipitated by solution of soda, then washed with alcohol, next re-converted into a sulphate, and boiled with animal charcoal to decolorize it. It occurs in short, oblique, shining prisms with dihedral summits, of a very bitter taste, more soluble in water (54 parts) than quinine sulphate, readily soluble by alcohol, and sparingly so by ether. It rotates polarized light to the right. By the addition of sulphuric acid it is converted into the more soluble neutral sulphate. It is now admitted to have the same remedial properties as quinine sulphate, but requires about one-third larger doses. *Quinidine sulphate* and *cinchonidine sulphate** are now official; both are soluble in water 1 to 100 parts.

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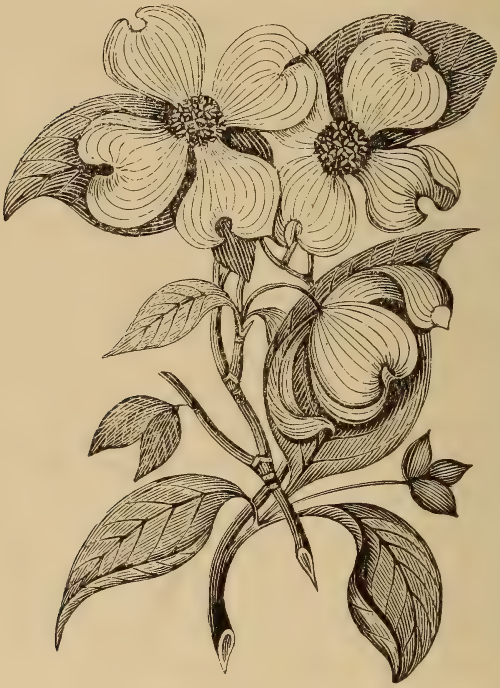
*In an able article by J. Marty, entitled, "Contribution à l'étude du sulphate de cinchonidine envisagé au point de vue physiologique et thérapeutique," *Bull. Gén. de Thérap.*, cvi, pp. 395, 445, 1884, the following conclusions are drawn, viz., that its action varies greatly; that occasionally therapeutic doses may prove toxic; and that it should be used only in mild cases, and in doses double those of quinine.

Their *effects* and *uses* are similar to those of quinine, as a substitute for which they are much used, but the dose is somewhat larger.

CORNUS.

Cornus florida, or Dogwood (*Nat. Ord.* Cornaceæ), is an indigenous tree found in most parts of the United States, and growing in the Middle States to the height of from fifteen to twenty feet. Its flowers are remarkable for large four-leaved white or pinkish involucres, which appear with us in May. The official portion is the BARK of the ROOT. It occurs in pieces of various sizes, more or less rolled, and of a reddish-gray color. Its taste is bitter, astringent, and slightly aromatic. It yields its virtues to water and alcohol, and contains *cornin* (cornic acid), *resin*, *tannic* and *gallic acids*, etc. The BARKS of Cornus sericea, or swamp-dogwood, and of Cornus circinata, or round-leaved dogwood, possess analogous properties.

FIG. 15.



CORNUS FLORIDA. INVOLUCRE.

Effects and Uses.—Dogwood is deservedly esteemed the best substitute for cinchona among the native astringent bitters. It is somewhat irritant, and not unfrequently disorders the stomach. Dose, in powder, gr. xx to ʒj; of the *fluid extract* fʒj or more.

SALIX.

The bark of Salix alba, the White Willow, and other species of Salix (*Nat. Ord.* Salicaceæ), is ranked among the astringent bitters. It is little employed, however, except in the form of SALICINUM (*salicin*, $C_{13}H_{18}O_7$, a glucoside) a *neutral principle* prepared from the *bark* of Salix Helix and other species of Salix, consisting of white, slender, silky crystals, inodorous but very bitter, soluble in water and alcohol, but not in ether. Salicin produces effects similar to those of salicylic acid (q. v.), and is employed in the same therapeutic range, especially in *acute rheumatism.* It renders the sweat alkaline. Dose, gr. x–xx, frequently repeated. It has antiseptic and antifermentative properties, but is not toxic.

PRUNUS VIRGINIANA—WILD CHERRY.

The Wild-cherry has long been known under the name of Prunus Virginiana, which is still retained by the Pharmacopœia. This name, however, belongs to another tree, the choke-cherry; and the wild-cherry is now properly distinguished as Prunus serotina (*Nat. Ord.* Rosaceæ). The medicinal portion is the bark of the root and trunk, the former of which is the more active. It is found in the shops in pieces of various lengths and sizes, deprived of the epidermis and slightly curved, of a reddish-brown color, and a bitter, slightly astringent, aromatic taste.

It contains a *bitter, amorphous principle** (not isolated), *resin, starch, tannic* and *gallic acids*, a ferment-principle not identical with emulsin, and yields on distillation a *volatile oil*, containing hydrocyanic acid, which does not pre-exist in the bark, but is formed by the reaction in water of the bitter principle and the ferment. The leaves also yield this oil. Boiling water impairs the virtues of the bark.

Effects and Uses.—Wild-cherry bark is tonic, with some astringency, and at the same time exercises a sedative influence on the nervous and circulatory systems, owing to the hydrocyanic acid which is developed in it. It is used with excellent effect as a sedative corroborant in the various forms of pulmonary irritation, particularly in the latter stages of *pneumonia* and in the hectic of *phthisis*. It is also a useful stomachic and tonic in a variety of cases. The *infusion* (4 parts to cold water enough to make the infusion weigh 100 parts), is given in the dose of f℥ij, twice or thrice daily. Of the *fluid extract* the dose is fʒj–ij. Of the *syrup*, an agreeable and efficient preparation in the treatment of pulmonary *cough*, the dose is f℥ss.

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* *Pharma. Rundschau*, Sept., 1887, p. 203, "On the Constituents of Wild Cherry Bark." Power and Weimer.

DIGESTIVE FERMENTS.

PEPSINUM—PEPSIN.

In connection with the subject of stomachic tonics, this article is entitled to brief mention. It is prepared from the rennets either of the calf, sheep or pig, taken from the animal as soon as killed, the best process being Scheffer's. The mucous membrane of well-cleaned, fresh hogs' stomach is scraped off, chopped fine, and macerated for several days in water acidulated with hydrochloric acid; the strained and decanted clear liquid is mixed with a saturated solution of sodium chloride in water, and the separated pepsin after several hours is drained on a muslin strainer, and submitted to a strong pressure. Pepsin, the ferment of the gastric juice, has the property, at 100° F. in an acid solution, of coagulating and dissolving albuminous principles. Two grains of pepsin, with an ounce of distilled water and ♏v of hydrochloric acid, will dissolve 100 grs. of coagulated white of egg at 98° F. in about four hours. Of *saccharated pepsin*, "1 part dissolved in 500 parts of water acidulated with 7.5 parts of hydrochloric acid should digest at least 50 parts of hard-boiled egg-albumen at 100° F. in five or six hours." Since alcohol impairs the digestive property of pepsin, preparations of it in wine are unreliable. Acid solutions favor its action, especially hydrochloric acid, and it may be combined with this acid if deficiency of the gastric juice be suspected. Glycerin is the most reliable agent for preserving the ferment of pepsin (Liebreich). The alkalies and mineral salts precipitate pepsin from solution, and hence are incompatible. Pepsin is now a good deal used in *dyspepsia*, *anemia* and in *diarrhœa*, especially that which occurs in infants or children, where the stools contain undigested food. It may be given in doses of gr. v–xx after each meal, suspended in syrup of orange-peel to disguise its disagreeable taste, or taken on bread. Of *saccharated pepsin*, the dose is gr. v to xx; of vinum pepsinæ, f℥ss–j, an inferior preparation. *Liquor pepsini* is a solution of saccharated pepsin (40 parts) in hydrochloric acid (12 parts), glycerin (400 parts), and water (548 parts); dose, f℥j–iv. It is probably more efficient in cases of children than of adults. When nourishment is to be given by the rectum (as when food is rejected by the stomach), the addition of pepsin and a little hydrochloric acid to animal broths for rectal injection is highly useful. *Ingluvin* is a preparation from the gizzard of the domestic fowl; it is an aid to digestion, its action depending, probably, more on the bitter-principle which it contains, and which stimulates the gastric glands, than to any digestive action of the preparation itself. It is recommended to allay various forms of reflex *vomiting*, especially the *vomiting of pregnancy*. Dose, gr. v–xv.

PANCREATINUM—PANCREATIN.

This is obtained, by Mattison's process, from the pancreas of recently-killed animals, which is dissected and macerated in water acidulated with hydrochloric acid for about forty-eight hours, then separated, and the solution of pancreatin is passed through a pulp-filter until it is perfectly clear; to this clear solution is then added a saturated solution of sodium chloride, and allowed to stand until the pancreatin is separated; this is skimmed off, and placed upon a muslin filter and allowed to drain, after which it is washed with a less concentrated solution of sodium chloride, and then put under the press; when all the salt solution is removed, and the mass is nearly dry, it is rubbed with sugar of milk, and dried without heat, after which it is diluted until ten grains emulsify two drachms of cod-liver oil. Saccharated pancreatin is employed to promote the digestion of fatty matters, as in *asthenia* and *anemia*, and may be administered in the form of emulsion, or dissolved in diluted alcohol or glycerin, or as a powder. As the activity of pancreatin is destroyed by acid, it should be given from 2 to 4 hours after meals. It is a good addition to cod-liver oil. Dose, gr. v–x. It is not official.

PAPAYA.

This is the dried juice of the half-ripe fruit of the Carica papaya (*Nat. Ord.* Papayaceæ), a white, slightly astringent powder, soluble in water, containing the ferment *papäin*. This principle has the property of digesting albuminoids and converting them into soluble albumen. According to Finkler, its action is that of a ferment, and not one of solution. Dr. Herschell* ascertained that it acted alike in acid, alkaline or neutral fluids, and that it would dissolve 1000 times its weight of fresh blood-serum. Antiseptics, as carbolic or salicylic acids, do not hinder its action. It has no effect on starch (Martin†). It dissolves intestinal worms and the diphtheritic membrane. It is said not to retain its activity except in the dry state. *Therapeutically* it is employed as an aid to digestion in the various forms of *dyspepsia*, to dissolve the *diphtheritic membrane*, and as a *tæniacide*. Prof. Jacobi‡ applies it to the diphtheritic membrane in glycerin, 1 part to 4; Schaffer uses it in water, strength 5 per cent.—both frequently applied with a brush. The dose is about gr. j–v, to be taken after meals in powder, aqueous solution, capsule, or compressed tablet.

Further investigation and clinical experience are needed to place papaya on its proper therapeutical footing.

MINERAL TONICS.

FERRI PRÆPARATA—PREPARATIONS OF IRON.

The preparations of IRON (FERRUM), termed *Ferruginea, Chalybeates* and *Martial* preparations, are the most important of the mineral tonics.

INCOMPATIBLES.—See each preparation.

AIDS.—Arsenic, quinine, nux vomica, gentian, beef-essence, the red wines, and malt-extract.

PHYSIOLOGICAL EFFECTS.—Besides their local tonic-astringent effect, and their general corroborant action on the cerebro-spinal system, which they possess in common with the other mineral tonics, they exercise a restorative influence on the composition of the blood, by increasing the number of its coloring particles and the amount of its solid constituents. Iron is in fact a natural constituent of the blood, and is to be considered as a nutrient rather than a medicine. The effects of the chalybeates are best observed in conditions of the system in which there is a relative want of the red corpuscles of the blood. Under their use in such cases, while the digestive functions are promoted, the pulse becomes fuller and stronger, the skin assumes a healthy tint, the lips and cheeks become more florid, the temperature of the body is increased, and the muscular strength is greatly invigorated. On the other hand, the administration of the ferruginous preparations in health, or too long continued, produces symptoms of plethora, vascular excitement, and a tendency to congestion and hemorrhage; though it may be doubted whether the blood will assimilate more than the normal proportion of iron. The iron-salts stain the teeth a dark color, and possess an astringent taste. Taken with the food they assist the digestive process; on an empty stomach, or when very large doses are taken, they irritate.

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* *Brit. Med. Journ.*, April, 1886, p. 640.

† *Journ. of Physiol.*, 1885, p. 336.

‡ *Therap. Gaz.*, 1886, p. 145.

The red corpuscles of the blood act as carriers of oxygen, which they take up from the inspired air in the lungs, and it is now believed that the iron in the blood-corpuscles converts oxygen into ozone, a more active form of this element. Iron is an essential constituent of hemoglobin, and observation has proven that a course of iron in anemia increases the number of red corpuscles to double or treble (Rabuteau). According to Cutler and Bradford this increase does not take place in health. The state in which it exists in the blood-corpuscles is unknown. Absorption: from the stomach it is thought to be absorbed as an albuminate. Metallic iron is oxidized, after ingestion, by the help of water. The ferrous oxide and carbonate are rendered soluble by the hydrochloric acid of the gastric juice. Salts of the organic acids may be absorbed directly into the blood, the acidulous radical being burnt off and the basic iron remaining to combine with the red globules. Salts of the mineral acids, the nitrate, chloride, and sulphate, in doses not large enough to constringe the tissues, are absorbed without change. Secretions: the astringent preparations of iron, as the chloride, sulphate and nitrate, lessen the secretions generally, especially the gastro-intestinal. The excretion of urea is increased. The ferric salts possess more activity than the ferrous. Elimination: iron is eliminated by the bile, feces and urine. The feces are, during a course of iron, of a dark color, owing to the formation of ferrous sulphide.

Medicinal Uses.—The diseases in which chalybeates are most serviceable are those which depend on a deficiency of the red corpuscles of the blood, as various forms of *anemia*, particularly where this is connected with irregularity of the uterine functions, as in *chlorosis*. In these conditions it is best given in rapidly-increasing doses pushed until it causes headache, vertigo, fever or some gastric disturbance, and laxatives should be occasionally administered during a course of iron, to unload the portal circulation and relieve the constipation which usually ensues; for the salts of iron after absorption pass directly through the liver, any unabsorbed portion acting as an astringent upon the gastro-intestinal canal. After its effects are obtained the size of the dose can be regulated to suit the case. When anemia is associated with gastric disturbance, the bitter tonics and acids are more serviceable than iron, which, however, may be given in the form of bitter wine of iron, as these symptoms subside. Iron is also frequently combined with arsenic in the treatment of anemia and chlorosis: ℞ Acidi arseniosi, gr. j; ferri reducti, gr. xxx; oleoresinæ capsici, gr. v. M. S.—Ft. pil. no. xxx; one pill t. d., increased to five daily if the arsenic be well borne. By some authors* the slightly soluble preparations (iron filings, or reduced iron) are given at first, followed, if well borne, by the more soluble ones. Iron in any form does harm in chlorosis or anemia accompanying the early stages of phthisis.† In the management of anemia and chlorosis important adjuncts will be found in rare meats, rich broths and suitable stimulation. Iron is also useful in *scrofula*, *tuberculosis*, degeneration of the viscera, and *cachectic* states of the system, characterized by paleness of the lips, face and conjunctivæ. Many forms of nervous disorders, as *neuralgia*, *chorea*, *hysteria* and *epilepsy*, are very decidedly controlled by the preparations of iron, and they probably constitute the best remedies in these affections, when attended with anemia. Several of the preparations of iron are also much employed both as stomachics and astringents.

The following are the official preparations of iron, which are needlessly multiplied in the U. S. P.:—

Ferrum Reductum (*Reduced Iron*). Metallic iron is obtained for medicinal purposes in the form of an impalpable powder by reducing the ferric hydrate by passing a stream of hydrogen gas over it. It is a light, tasteless, iron-gray powder, insoluble in water, but completely soluble in diluted sulphuric acid, and it should be kept in a well-stoppered bottle, owing to its great liability to oxidation. This preparation, sometimes called *Quevenne's Iron*, is a mild chalybeate, and is a favorite prescription with many practitioners in the treatment of *chlorosis* and other varieties of *anemia*. Dose, gr. v to x, three times a day, after meals, in the form of pill made with sugar and gum; or it may be swallowed readily in a bolus of soft bread. It is sometimes prepared with chocolate in the form of lozenges. It is well adapted to prolonged use.

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* Trousseau et Pidoux, 9th ed., Vol. 1, 1880, p. 5.

† *Ibid.*, p. 7.

Ferri Oxidum Hydratum (*Hydrated Ferric Oxide*). This preparation (*ferric hydrate*) ($Fe_2 6HO$) is made by precipitating the ferric hydrate from its combination in any ferric salt (officially, ferric sulphate) by means of ammonia. When dry, it is a reddish-brown powder, and it is not an eligible preparation for medicinal use. It is furnished in the form of a freshly-precipitated, soft, moist, reddish-brown magma for use as an antidote to arsenious acid.

Ferri Oxidum Hydratum Cum Magnesiâ (*Hydrated Ferric Oxide with Magnesia*). In this preparation ferric hydrate is precipitated by means of magnesia, instead of ammonia. It is readily prepared, and is used as an antidote to arsenious acid. It is to be preferred to the ordinary hydrate, because the magnesia by its purgative action aids in the removal of any of the poison which may remain after the action of emetics or the use of the stomach pump,

Ferri Carbonas Saccharatus (*Saccharated Ferrous Carbonate*) is obtained by the double reaction of ferrous sulphate and sodium bicarbonate, and is protected from oxidation by the addition of sugar. It is a greenish-gray powder, oxidizing slowly in the air, only partially soluble in water, but completely soluble in hydrochloric acid. It is a valuable preparation, particularly adapted to cases of weak digestion as in *anorexia* and *asthenia*, when iron is indicated. Dose, gr. v-xxx.

Trochisci Ferri (*Troches of Iron*) are made with ferric hydrate, vanilla, sugar and mucilage of tragacanth; each lozenge contains of the iron gr. v.

Emplastrum Ferri (*Plaster of Iron*) is made with ferric hydrate, lead-plaster, Burgundy pitch, and Canada turpentine.

Massa Ferri Carbonatis (*Pill of Ferrous Carbonate*)—*Vallet's Ferruginous Mass.* To protect the ferrous carbonate ($FeCO_3$) from oxidation, it is prepared (as in the process last described) by dissolving the reacting salts in weak syrup instead of water; honey and sugar being afterward added to preserve it unaltered and bring it to the pilular consistence. This preparation is one of the most popular ot the chalybeates. It contains nearly half its weight of ferrous carbonate. From gr. v-xx of the pilular mass may be taken in divided doses through the day.

Mistura Ferri Composita (*Compound Iron-Mixture*) (*Griffith's anti-hectic mixture*) is a mixture of ferrous sulphate and potassium carbonate with myrrh, spirit of lavender, rose-water and sugar, to resist oxidation. It is a favorite chalybeate in *chlorosis* and *amenorrhœa*. Dose, f℥j to ij, t. d.

Pilulæ Ferri Compositæ (*Compound Iron-Pills*) are prepared with sodium carbonate and ferrous sulphate with myrrh and syrup. Dose, from two to six pills three times a day. Both these preparations should be made only as wanted for use.

Ferri Sulphas (*Ferrous Sulphate*) ($FeSO_4.7H_2O$), known, in its impure state, as *green vitriol* or *copperas*, is prepared for medicinal use by dissolving iron-wire in diluted sulphuric acid, with heat. It occurs in transparent, pale bluish-green crystals, of the form of oblique rhombic prisms, of an acrid, styptic taste, soluble in water, but insoluble in alcohol. By exposure to the air they effloresce, absorb oxygen, and become yellowish-white, from the formation of ferric sulphate. When heated to 239°, they give out six of their seven equivalents of water, and are converted into a grayish-white mass known as the *dried* sulphate. The alkalies and alkaline earths and their carbonates, silver nitrate, and lead acetate, are *incompatible* with this salt. Ferrous sulphate is one of the most active of the ferruginous preparations, but its local effects are powerfully astringent, and in a concentrated form it acts as an irritant poison. It is preferred to other chalybeates where there is much relaxation of the solids, with excessive discharges; but it is not so well adapted to long-continued use, on account of its local irritant action. *Topically*, it is employed in substance and solution as a styptic and astringent. Dose, gr. j-v, in pill; of the *dried sulphate* (*ferri sulphas exsiccatus*), gr. ss-iij. A good tonic-combination is ℞ Ferri sulphatis exsiccati, gr. j; extracti nucis vomicæ, gr. ½; extracti gentianæ, gr. ij. M. S. Ft. pil. No. I; one pill 3 or 4 times daily. Ferrous sulphate is also used as a disinfectant, dissolved in water, (℔j to O viij) to cleanse privies, drains, etc., under the name of *copperas*.

Ferri Sulphas Præcipitatus (*Precipitated Ferrous Sulphate*). In this preparation the ferrous sulphate is precipitated from an aqueous solution by alcohol. Dose, gr. j-v.

Liquor Ferri Tersulphatis (*Solution of Iron Tersulphate*) (Fe_23SO_4). This preparation is made by dissolving ferrous sulphate in a mixture of sulphuric and of nitric acids, with water. The nitric acid furnishes oxygen, which converts the iron from a ferrous to a ferric condition. It is a solution of the *normal ferric sulphate.* This solution is a clear, reddish-brown liquid, nearly devoid of odor, and of a sour, very styptic, and somewhat acrid taste. Its chief use is in making ferric hydrate, and it should be kept on hand for the preparation of the antidote for arsenious acid. It may be used as a styptic, but for this purpose it is inferior to the next preparation.

Liquor Ferri Subsulphatis (*Solution of Iron Subsulphate*) (*Monsel's Solution*) is made in the same way as the last preparation, except that only half the amount of sulphuric acid is used, and a basic ferric sulphate results (Fe_4O5SO_4). It has a syrupy consistence, a ruby-red color, is inodorous, and has a very astringent but not acrid taste. This is a solution of the *basic ferric sulphate*, and is less irritant than that of the normal ferric sulphate. It may be used internally, in *hemorrhage* from the stomach and bowels, in the dose of from ♏v-xv. *Externally*, it is one of the most efficacious styptics we can employ; and has been injected into *nævi* with success, and applied by means of the atomizer, and has been found efficient in *hemoptysis.* Diluted with water, it is a good local application to inflamed mucous surfaces. Cotton saturated with Monsel's solution (*styptic cotton*) and dried, may be pressed firmly into a wound to *arrest capillary oozing*, and introduced within the nose to stop *epistaxis.*

Ferri Chloridum (*Ferric Chloride*) ($Fe_2Cl_6.12H_2O$) is made by heating iron-wire with hydrochloric acid (by which ferrous chloride is formed), and afterward converting the ferrous into ferric chloride by heating it with hydrochloric and nitric acids. It occurs in fragments of a crystalline structure, an orange-yellow color, inodorous, of a strong chalybeate, styptic taste, deliquescent, and wholly soluble in water, alcohol and ether. *Internally*, it is used chiefly in the form of the *tincture.* *Externally*, it is applied as a styptic, and in solution, of various strengths, as an astringent. One part, gradually added to six parts of collodion, forms a yellowish-red, limpid liquid, of valuable styptic properties.

Liquor Ferri Chloridi (*Solution of Ferric Chloride*) is prepared by dissolving iron-wire in hydrochloric acid, heating to the boiling point, then heating the liquid, after filtration, with hydrochloric and nitric acids, and afterward adding distilled water. A reddish-brown liquid, having an acid and strongly styptic taste, and sp. gr. 1.405.

It may be used *internally* for the purposes of the chloride, in doses of ♏ij-vj, diluted, and *externally* as a styptic.

Tinctura Ferri Chloridi (*Tincture of Ferric Chloride*) is made by mixing 35 parts of *solution of ferric chloride* with 65 parts of alcohol. It is a tincture of the chloride, though there is probably some reaction between the acid and the alcohol, as the preparation has an ethereal odor. It is of a reddish-brown color, and has a sour, styptic taste. It is one of the most effective of the chalybeates, acting *locally* as an energetic astringent and styptic, and, in large doses, as an irritant. Its indications, both general and topical, are very analogous to those of the sulphate, and *it is the preparation of iron usually employed internally*. It is especially useful in *anemia*, *erysipelas*, *septicemia* and *pyemia*, *ascites*, *cerebral anemia*, *rheumatic arthritis* and *hypochondriasis*, where there is evident deficiency of red coloring matter in the blood. It is also often serviceable in *angina pectoris* (attack), as a tonic in *emphysema*, *cardiac dilatation*, *hemiplegia* and *paralysis agitans*. Dose, ♏x to xxx, which may even be gradually increased to f℥j, in certain diseases (as erysipelas). Tincture of ferric chloride is decomposed by the alkalies, alkaline earths, and their carbonates; also by vegetable infusions containing tannin and mucilago acaciæ, which throw down a brownish, partly transparent, jelly-like mass, and which are accordingly *incompatible* with it. It should be taken well diluted after eating, and through a glass-tube to avoid injury to the teeth. Attention has been called by Prof. T. D. Reed* to the addition of potassium citrate in prescribing tincture of ferric chloride, which forms with it (probably ferric citro-chloride) a clear, light-green solution, possessing similar ferruginous properties, free from the roughness of the iron, and compatible with the astringents and bitters. ℞ Tincturi ferri chloridi, f℥ij; potassii citratis, ℥j; syrupûs limonis, f℥jss; aquæ, ad f℥vj. M. S.—One tablespoonful represents ♏x of the iron—an elegant preparation. This combination may be prescribed with the salicylates which are otherwise incompatible with iron.

Mistura Ferri et Ammonii Acetatis (*Mixture of Iron and Ammonium Acetate*) (*Basham's Mixture*) is made with tincture of ferric chloride, diluted acetic acid, solution of ammonium acetate, elixir of orange, syrup and water. By the reaction of the ferric chloride and ammonium acetate, ferric acetate and ammonium chloride are formed. A most excellent preparation, and of great benefit in chronic *albuminuria*, and in chronic *dropsies* generally where iron is indicated. Dose, fʒss-j. It forms with quinine an acetate of the alkaloid.

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* *Canada Med. and Surg. Journ.*, August, 1881, p. 7.

Ferri Iodidum Saccharatum (*Saccharated Ferrous Iodide*). This salt is made by the addition of iron-filings to a mixture of iodine in distilled water, and sugar of milk is added to prevent oxidation. By evaporation a yellowish-white or grayish powder is obtained, of a sweetish, ferruginous taste, deliquescent, and very soluble in water. Dose gr. x-xxx.

Syrupus Ferri Iodidi (*Syrup of Ferrous Iodide*), which is prepared by mixing iodine and iron-wire in distilled water, and shaking the mixture until the solution has acquired a green color, adding syrup, heating to 212°, straining, and, when the liquid has cooled, adding distilled water. It must be kept in well-stoppered vials. It is a transparent liquid, of a pale-green color, and furnishes an excellent alterative tonic, combining the effects of iodine and of iron, and is particularly applicable to the treatment of *scrofula*, *rickets*, and *phthisis*. It is *incompatible* with the alkalies, their carbonates, and tannin: with potassium chlorate a dangerous reaction takes place, free iodine being liberated. Dose, ♏v-fʒj.

Pilulæ Ferri Iodidi (*Pills of Ferrous Iodide*) are made with iodine, reduced iron, sugar, acacia, glycyrrhiza, extract of glycyrrhiza, and an ethereal solution of balsam of tolu. They keep very well. Each pill contains about gr. j of ferrous iodide and gr. ¼ of reduced iron.

Ferri et Potassii Tartras (*Iron and Potassium Tartrate*) is prepared by the addition of ferric hydrate to a mixture of potassium bitartrate in distilled water. It occurs in transparent scales of a ruby-red color, which are wholly soluble in water. The tartaric acid and potash, in combination in this preparation, render it less constipating than the other chalybeates; and, from its agreeable taste, it is adapted to the diseases of childhood. It is, moreover, not incompatible with the alkalies. Dose, gr. x-ʒss.

Ferri Phosphas (*Ferric Phosphate*) is obtained by the double reaction of solutions of ferric citrate and sodium phosphate and evaporating to dryness. It occurs in bright-green transparent scales, insoluble in alcohol, but soluble in water; by exposure to the light it becomes darker. According to Rother[*] it is a combination of ferric phosphate and sodic citrate. Dose, gr. v-x, in pill.

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[*] *Am. Jour. Pharm.*, 1876, p. 171, and 1883, p. 163.

Ferri Pyrophosphas (*Ferric Pyrophosphate*) ($Fe_43P_2O_7.9H_2O$). It occurs in apple-green scales, of an acid, slightly saline taste, and is very soluble in water. A good chalybeate. Dose, gr. ij-v. Given also as a *syrup.*

Ferri Hypophosphis (*Ferric Hypophosphite*) ($Fe_26H_2PO_2$) is obtained by the reaction of a solution of sodium or ammonium hypophosphite with a solution of ferric sulphate. It is a white, amorphous powder, insoluble in cold water, soluble in hydrochloric acid, incompatible with the soluble salts of mercury and silver, but has the advantage of not being decomposed by the cincho-tannic acid of cinchona. This is a good chalybeate in diseases of degeneration of the nervous tissue, and has been also given in *phthisis;* other hypophosphites are combined with it. Dose, gr. x-xxx, t. d.

Ferri Citras (*Ferric Citrate*) ($Fe_22C_6H_5O_7.6H_2O$) is prepared by the addition of ferric hydrate to a solution of citric acid, and occurs in thin, transparent pieces, of a garnet-red color, with a mild, acid, chalybeate taste, slowly soluble in cold water, but readily soluble in boiling water. Dose, gr. v-x. It is official also in the form of *Liquor Ferri Citratis* (*Solution of Ferric Citrate*), a deep reddish-brown liquid, given in doses of gtt. x-xx; and it is by evaporating this solution that the solid citrate is obtained.

Liquor Ferri Nitratis (*Solution of Ferric Nitrate*) (Fe_26NO_3) is prepared by the gradual addition of diluted nitric acid to ferric hydrate. It is a pale, amber-colored liquid, with a strong, astringent acid taste. It is tonic and astringent, agreeing very well with the stomach, and is employed in the treatment of *chronic diarrhœa, hematemesis, hemorrhage* from the bowels, *hematuria* and *uterine hemorrhage,* particularly when anemic symptoms are present. Dose, gtt. x-xx, t. d., in dilution.

Syrupus Ferri Bromidi (*Syrup of Ferrous Bromide*) contains 10 per cent. of ferrous bromide. It may be given with advantage where a bromide and iron are both indicated, notably in *chorea* occurring in delicate girls at the age of puberty, and associated with anemia. Dose, f℥j.

Ferri Oxalas (*Ferrous Oxalate*) ($FeC_2O_4.H_2O$) is made by the reaction of solutions of oxalic acid and ferrous sulphate. It occurs as a lemon-yellow, crystalline powder, almost destitute of taste, slightly soluble in water, but easily acted upon by the diluted acids, and decomposed by the alkalies and their carbonates. This chalybeate has the advantage of being well borne by the stomach, and of being readily absorbed, while it is nearly destitute of astringency, and not disposed to change like the ferrous salts generally. Dose, gr. ij-iij, in pill, t. d.

Liquor Ferri Acetatis (*Solution of Ferric Acetate*). Dose, ♏x-xxx. Chiefly used in preparing

Tinctura Ferri Acetatis (*Tincture of Ferric Acetate*), a solution of ferric acetate in alcohol and acetic ether. Dose, ♏x-f℥ss, or more.

Ferri Lactas (*Ferrous Lactate*) is made by mixing diluted lactic acid with iron-filings. It occurs in greenish-white crystalline crusts or grains of a mild, sweetish, ferruginous taste, sparingly soluble in water, and insoluble in alcohol. Used in *chlorosis* it has a marked effect in increasing the appetite. Dose, gr. x-xx, in *pill*, *lozenge* or *syrup*.

Ferri et Quininæ Citras (*Iron and Quinine Citrate*). This salt is prepared by dissolving quinine in a hot solution of iron citrate and evaporating the solution. As found in the shops, it is a mechanical mixture of ferric citrate with a variable proportion of iron and quinine citrate. It occurs in thin, transparent scales, of a reddish or yellowish-brown color, with a tint of green, not very soluble in water, and of a ferruginous, moderately bitter taste. It combines the virtues of its two bases, and is thought to have an especial agency in diminishing the formation of urea, whence its use in *uremia*. Dose, gr. v-x.

Liquor Ferri et Quininæ Citratis (*Solution of Iron and Quinine Citrate*). Dose, f℥j.

Vinum Ferri Amarum (*Bitter Wine of Iron*) is a mixture of solution of iron and quinine citrate, tincture of sweet orange-peel, syrup and stronger white wine. Dose, f℥j–ij.

Ferri et Ammonii Citras (*Iron and Ammonium Citrate*) is made by adding water of ammonia to solution of iron citrate, and evaporating. It occurs in the form of garnet-red translucent scales, of a slightly ferruginous taste, and is readily soluble in water; it has antacid properties. Dose, gr. v–x.

Vinum Ferri Citratis (*Wine of Citrate of Iron*), a solution of ammonio-ferric citrate in tincture of sweet orange-peel, syrup and stronger white wine. Dose, f℥j.

Ferri et Strychninæ Citras (*Iron and Strychnine Citrate*) is made by mixing a solution of strychnine and citric acid in distilled water with a solution of iron and ammonium citrate in water and evaporating. It occurs in garnet-red scales, of a bitter, ferruginous taste, readily soluble in water. An excellent tonic. Dose, gr. ij–iij, t. d.

Syrupus Ferri, Quininæ et Strychninæ Phosphatum (*Syrup of Iron, Quinine and Strychnine Phosphates*), an agreeable tonic. Dose, f℥j.

Ferri et Ammonii Sulphas (*Iron and Ammonium Sulphate*, $(NH_4)_2Fe_2(SO_4)_4.24H_2O$). This salt, called also *ammonio-ferric alum*, is made by adding ammonium sulphate to a hot solution of ferric sulphate. It occurs in octahedral crystals, of a pale-violet color and sour, astringent taste, efflorescent, and very soluble in water. Used in *diarrhœa* and *chronic dysentery*. Dose, gr. v–xv, two or three times a day.

Ferri et Ammonii Tartras (*Iron and Ammonium Tartrate*) $(2(FeO)NH_4C_4H_4O_6.5H_2O)$ occurs in transparent, garnet-red scales, of a sweetish taste, soluble in water, insoluble in alcohol and ether. A mild chalybeate. Dose, gr. x–xxx.

Ferri Valerianas (*Ferric Valerianate*), a dark, tile-red, amorphous, unstable powder,* with a mildly styptic taste and an odor of valerianic acid; insoluble in cold water, but readily soluble in alcohol. Dose, gr. j–iij.

Ferrum Dialysatum (*Dialyzed Iron*) has been introduced as a substitute for the tincture of ferric chloride, than which it is much less efficacious. It is not apt to constipate, is almost tasteless, and may be given in doses of from gtt. xv–l daily. Dialyzed iron is an antidote to arsenic in the stomach. To ensure its conversion into ferric hydrate in the stomach, its ingestion should be followed by a tablespoonful of sodium chloride. It is not official.

Pills of aloes and iron, and *syrup of the hypophosphites with iron* are also official.

CHALYBEATE WATERS—NORTH AMERICA.

Schooley's Mountain Springs (*Morris County, New Jersey*). Analysis by C. McIntire, Jr. One pint contains a small proportion of the sodium, magnesium, manganesium, calcium and iron carbonates with carbonic acid gas.

Cresson Springs (*Cambria County, Pennsylvania*). Analysis by F. A. Genth. There are three springs, viz., the Iron, Alum and

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* Arch. de Neurol., xix, 1890, p. 229. Valerian et ses preparations, par Yvon.

Magnesia. The Iron contains nearly gr. ½ of the carbonate and gr. iij of ferrous sulphate to the pint, besides the earthy and alkaline carbonates, chlorides, etc.

Rawley Springs (*Rockingham County, Virginia*). Analysis by Prof. J. W. Mallet. One pint contains iron carbonate gr. ⅕ besides the magnesium, calcium, and manganesium carbonates.

New Almaden Vichy (*Santa Clara County, California*). One U. S. gallon contains gr. 5 of iron carbonate with sodium bicarbonate gr. 201, and chloride gr. 33, and Epsom salt gr. 12; also 238 cub. in. of free carbonic acid gas.

The Sharon Chalybeate Spring (*New York*) contains iron sulphate gr. 24 to the U. S. gallon; **Schuyler Chalybeate Spring** (*New York*) iron sulphate gr. 70 to the U. S. gallon; **Thorp's Spring** (*Hood County, Texas*) iron carbonate gr. 40 to the U. S. gallon.

CHALYBEATE WATERS—EUROPE.

Schwalbach and **Pyrmont** (*Germany*); **Spa** (*Belgium*), and **Saint Moritz** (*Switzerland*). The first named contains almost gr. ½ of iron carbonate to the pint, a large quantity of carbonic acid and a few other mineral ingredients; in Pyrmont is found about gr. ⅓ of iron carbonate to the pint, and also a large proportion of calcium sulphate and other salts, so that it is not a pure chalybeate. The waters of Spa are almost purely chalybeate, containing gr. ⅔ of iron carbonate to the pint and much carbonic acid gas. The Saint Montz yields about gr. ⅙ of iron carbonate to the pint and it is therefore a fair ferruginous water.

The waters of this class, which owe their virtues to the presence of iron in the form of bicarbonate or sulphate kept in solution by carbonic acid gas, are mostly limpid and colorless. If the iron be present in large quantity their taste is astringent. They produce effects similar to the official preparations of iron, with the additional advantage of change of life, scene and climate, which is conferred by a sojourn at these springs. The iron waters are indicated in *anemia* and *chlorosis*, and in cases generally suited to the iron-preparations.

MANGANI PRÆPARATA—PREPARATIONS OF MANGANESE.

Manganese (Mn) is a normal constituent of the body, existing in small amounts in the blood, hair, bile, etc. When given *internally* in small doses the appetite improves, the digestive functions are promoted and the body gains in weight; these effects are supposed to be most conspicuous in conditions due to an insufficiency of iron, and probably of manganese, in the blood. If a large dose be taken the cardiac action is depressed and the blood-pressure lowered. After a toxic dose violent gastro-enteritis ensues. Injected into the blood, or given hypodermically, the salts of manganese paralyze voluntary motion and reflex action and arrest the heart in diastole. They have been used as substitutes for, or combined with, the iron salts, in *anemia*, *chlorosis*, and *cachectic* states, but are inferior to the latter remedies.

The following are the official preparations:—

Mangani Oxidum Nigrum (*Manganese Black Oxide*) is the "native, crude Manganese Binoxide, containing at least 66 per cent. of the pure oxide (MnO_2)." It is a heavy, grayish-black, amorphous or crystalline powder, odorless, tasteless and insoluble in water or alcohol. It has been used as a substitute for iron in the above-mentioned diseases and as a substitute for bismuth in *gastrodynia* and *pyrosis*. Dose, gr. j–x in pill, capsule or powder.

Mangani Sulphas (*Manganese Sulphate*) ($MnSO_4.4H_2O$) occurs in transparent and colorless or pale rose-colored crystals, slightly efflorescent in dry air; without odor, but having a faintly bitter, astringent taste; soluble in water but not in alcohol. Its effects are those as above stated, and it is much more active than the black oxide. It is believed, also, to act as a cholagogue, and it has been used for this purpose in *jaundice*, especially when due to catarrh of the biliary ducts. It has also been used as a substitute for iron. Dose, gr. ij–v.

Potassium Permanganate is considered among the antiseptics, *q. v.*

ACIDA MINERALIA—MINERAL ACIDS.

INCOMPATIBLES.—Nitric, nitro-hydrochloric and hydrochloric acids being powerful oxidizing agents form explosive compounds with readily oxidizable substances as the carbohydrates, alcohols, ethers, sulphur, phosphorus and the sulphides. The mineral acids are incompatible with the salts of lime, lead, silver, the carbonates, and hydrates, and they liberate the weaker acids in combination, and decompose the glucosides.

AIDS.—The tonics, bitters and pepsin, the latter with HCl.

PHYSIOLOGICAL EFFECTS.—The diluted mineral acids are usually classed with tonics; but, although they exert a very considerable corroborant influence on the system, their action is in many respects peculiar and distinctive. In the concentrated form they are corrosive. When properly diluted with water and swallowed in medicinal doses, they allay thirst, increase the appetite, stimulate digestion, increase the flow of bile by duodenal irritation, and all possess great diffusive power. After absorption into the blood, they combine either with its alkaline bases or albumen, and often produce a restorative effect in morbid conditions of the circulating fluid, and in their passage out by the secretions act as astringents. According to Gubler, the mineral acids exist in the blood loosely combined with albumen, and by the action of the excretory organs this combination is broken up, the albumen remaining in the vessels, the acid passing out united with other bases. *Acids* given on an *empty stomach check* the *secretion* of the *acid gastric juice;* given on a *full stomach* they render its contents *more acid;* hence, if there be an excess of acid secreted by the stomach, they should be exhibited before meals, in small doses and well diluted; while if there be too little acid secreted, they may be given after meals to supply the deficiency. *They are employed*—as tonics, usually in combination with the vegetable bitters, in *dyspepsia*, especially where it is dependent on a deficiency of the gastric fluid, in *typhoid* and other essential fevers, in *purpura* and in *scurvy;* as astringents and styptics, in *hemorrhage* from the stomach and bowels, and in colliquative *sweats* and *diarrhœa;* to allay febrile heat and cutaneous irritation; in *phosphatic lithiasis;* and *locally*, as escharotics; and in very dilute solutions they are injected into the bladder as lithontriptics. *In cases of poisoning* from the mineral acids the proper antidotes are the alkalies or the alkaline earths to neutralize the acid and thus render it inert, and the free use of the fixed oils or albumen to protect the surface of the alimentary tract.

Acidum Sulphuricum (*Sulphuric Acid*) (H_2SO_4), formerly called *Oil of Vitriol*, is obtained by burning sulphur, mixed with nitre, over a stratum of water contained in a chamber lined with sheet-lead. It is a dense, colorless, inodorous, corrosive liquid, of a strongly acid taste and an oily consistence, which unites with water in all proportions with the evolution of heat. Its sp. gr. should not be lower than 1.840. It should contain not less than 96 per cent. of absolute sulphuric acid, and not more than 4 per cent. of water. The diluted acid is readily detected by a soluble barium salt, which precipitates a *white* insoluble barium sulphate; veratrine introduced into the diluted acid, and evaporated to dryness, leaves a *crimson* deposit. In the concentrated form it is not employed *internally*, but is sometimes used *externally* as a caustic, acting by coagulating albumen, and its affinity for water and the organic bases. When swallowed, it acts as a violent corrosive poison, causing a burning pain in the mouth, throat and stomach, and usually staining the lips, mouth and fauces with black sloughs; occasionally the action of the poison is spent upon the upper part of the larynx, and death takes place from asphyxia, without the entrance of the poison into the stomach. The chemical *antidotes* are magnesia, chalk, the alkalies or solution of soap, and mucilaginous drinks should be afterward freely administered.

Acidum Sulphuricum Dilutum (*Diluted Sulphuric Acid*) contains one part of sulphuric acid and 9 parts of distilled water. It therefore contains 10 per cent. of the official (not the absolute) sulphuric acid. Diluted sulphuric acid lessens thirst, aids digestion, and diminishes the secretions of the bowels and skin. It is given as a *tonic*, *refrigerant* and *astringent*, in the dose of from gtt. x–xxx, t. d., in water, and should be sucked through a tube to prevent injury to the teeth. This acid is a particularly valuable remedy in *typhus* and *typhoid fevers*, colliquative *sweats*, *cholera* and choleraic *diarrhœa;* and it is the best corrective for *phosphatic lithiasis*. It is used *externally* as a gargle and a wash to ulcers.

It may be taken in the natural form since the water of the OAK-ORCHARD ACID SPRING of Genesee County, New York, yields gr. x, of free sulphuric acid to the pint and is well adapted to prolonged use as in *phosphatic lithiasis*.

Acidum Sulphuricum Aromaticum (*Aromatic Sulphuric Acid*), or *Elixir of Vitriol*, is made by adding 200 parts of sulphuric acid to 700 parts of alcohol and allowing the mixture to cool, then add 45 parts of tincture of ginger and 1 part of oil of cinnamon, with sufficient alcohol to make the product weigh 1000 parts. It is a reddish-brown liquid, with an aromatic odor and a pleasant acid taste; and is an agreeable substitute for the diluted sulphuric acid, administered in the same doses.

Acidum Nitricum (*Nitric Acid*) (HNO_3) is obtained by the action of sulphuric acid upon potassium nitrate. When pure it is colorless; but as found in the shops it is usually of a straw-color, owing to the presence of nitric peroxide. It should have a sp. gr. 1.420 and contain 69.4 per cent. of anhydrous acid. It is a corrosive, sour liquid, evolving white fumes when exposed to the air. It may be recognized by giving off dense red fumes when added to copper-turnings, by the morphine test (see morphina), and by striking a blood-red color, changing to yellow in minute quantity, with solution of sulphuric acid and brucine. Nitric acid is readily absorbed by the blood, and probably exists there either in the form of nitrates or combined with albumen (Gubler). Nitric acid stimulates the glandular apparatus of the intestinal canal, apparently due to a local action. It is probably eliminated as a nitrate by the kidneys. *Locally*, nitric acid is a powerful *caustic*, acting by abstracting water and combining with the alkaline bases of the tissues. It is employed, in the concentrated form, as an escharotic to destroy *warts* and stimulate indolent sinuses, and diluted, as an astringent wash or gargle. Atthill* applies the fuming nitric acid within the uterus successfully, in the treatment of *menorrhagia* due to granulations of the mucous membrane, in hemorrhage after the removal of a polyp, and in *endometritis*, on cotton wrapped round copper-wire or a catheter, the cervix being protracted by a vulcanite tube. He states that applied in this way it seldom causes pain. It is also applied to the pustules of *acne*, and as a cauterant to *nævi*, *phagadena*, and *rodent ulcer*. Cases of poisoning from this acid are to be treated with magnesia, the alkalies, or soap, and mucilaginous drinks. In poisoning from nitric acid, the fauces and mouth are covered with yellow eschars, due to the formation of picric acid. *Internally*, it is used in the form of—

Acidum Nitricum Dilutum (*Diluted Nitric Acid*), which contains one part of nitric acid and six parts of water, by weight; or 10 per cent. of absolute acid. This is given as a substitute for sulphuric acid. Dose for internal use ♏ij–xx, t. d., reduced with water.

Acidum Hydrochloricum (*Hydrochloric Acid—Muriatic Acid*) is an aqueous solution of hydrochloric acid gas (HCl), of sp. gr. 1.160, and is obtained by the action of sulphuric acid on a solution of sodium chloride. The official acid is composed of 31.9 per cent. of absolute hydrochloric acid, and 68.1 per cent. of water. It is, when pure, a transparent, colorless liquid, but has often a yellow color, owing to the presence of chlorine, iron, or other contamination. It gives off dense white fumes when in contact with ammonia, and evolves chlorine gas when heated with manganese dioxide;

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* "Clinical Lectures on Diseases Peculiar to Women," 1883, pp. 104, 199, 378.

in the diluted state it produces, with solution of silver nitrate, a white precipitate, insoluble in boiling nitric acid, but soluble in ammonia. *Locally*, it is an active caustic, abstracting water and uniting with the alkaline bases of the tissues. Strong baths of hydrochloric and other mineral acids exert a powerful influence upon the skin. Hydrochloric acid is readily absorbed by the stomach, either as a chloride or joined with albumen. Hydrochloric acid, in small quantities, augments the digestive power of the gastric juice, and, probably, exists normally in that fluid. Hydrochloric acid is chiefly eliminated by the urine. It has a corrosive taste and a suffocating odor, and is an active poison, though less irritating than sulphuric and nitric acids. A poisonous dose produces blackness of the lips, redness of the tongue, difficulty in swallowing, and violent gastric pain. Magnesia, soap, or the alkalies are the chemical antidotes: afterward mucilaginous drinks should be given. It is used *externally* as a caustic, and as an application in *diphtheria*, ulcerative and gangrenous *stomatitis*, and, *internally*, in the form of

Acidum Hydrochloricum Dilutum (*Diluted Hydrochloric Acid—Diluted Muriatic Acid*), which contains 6 parts of the official acid and 13 parts of water, by weight; or 10 per cent. of the absolute acid. This is employed in *typhoid* and *typhus fevers;* also to counteract *phosphatic deposits* in the urine, and in *dysentery*. In gastric *dyspepsia* attended with deficiency of the gastric juice, since it exists probably normally* in this fluid, it is useful, especially when combined with pepsin; the liquor pepsini, as it contains both remedies, is an eligible preparation in this condition and should be taken after meals. Dose, ♏v–xx, which may be given in infusion of rose.

Acidum Nitro-Hydrochloricum (*Nitro-Hydrochloric Acid—Nitro-Muriatic Acid*). This acid is made by mixing 4 parts of nitric acid with 15 parts of hydrochloric acid, the resulting reaction liberating chlorine, and forming chloronitrous acid and water, as follows: $HNO_3 + 3HCl = Cl_2 + NOCl$ (chloronitrous acid) $+ 2H_2O$. It has a deep golden-yellow color, and emits the smell of chlorine, which is the chief active constituent. *Internally*, it is employed as a stomachic tonic, and is thought also to be particularly efficacious in *oxaluria*, and diseases of the liver, as *jaundice* due to catarrh of the bile ducts. Rutherford's experiments on dogs show that it is an hepatic stimulant. It should not be given with mercurials. *Exter-*

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* "Human Physiology," 1887. p. 139. Chapman.

nally, it is used as a bath, either local or general, in *oxaluria* and *chronic hepatitis*, for which purpose one to four ounces of the acid may be added to a gallon of water. Dose, from gtt. ij–v, properly diluted, and carefully increased.

Acidum Nitro-Hydrochloricum Dilutum (*Diluted Nitro-Hydrochloric Acid—Diluted Nitro-Muriatic Acid*) is made by mixing nitric acid (4 parts) with hydrochloric acid (15 parts), and, when effervescence ceases, adding distilled water (76 parts). Dose, ♏ij–x.

Acidum Phosphoricum (*Phosphoric Acid*) is made by boiling phosphorus in nitric acid and water, and driving off the nitrous compounds by heat. It contains 50 per cent. each of orthophosphoric acid (H_3PO_4) and distilled water, and is "a colorless liquid, without odor, of a strongly acid taste and reaction," and has a sp. gr. of 1.347. It is a powerful caustic, penetrating the tissues very deeply. In its *effects* it resembles the other acids. In small doses, well diluted, it stimulates digestion and increases the circulation; when given for too long a time it disorders digestion by diminishing the secretion of the acid gastric juice. In large doses it depresses the circulation, acting as a corrosive poison. Cases of poisoning by phosphoric acid are to be treated on general principles, viz.: neutralize the acid by the alkalies, alkaline earths or soap; protect the denuded surface by eggs, milk or mucilaginous drinks; and counteract the resulting depression by opium, nutrient and stimulating injections, etc. It is *used* internally in the form of

Acidum Phosphoricum Dilutum (*Diluted Phosphoric Acid*) which is prepared by adding 20 parts of phosphoric acid to 80 parts of distilled water. It is a colorless, syrupy liquid, without smell, but having a sour taste, and contains 10 per cent. of orthophosphoric acid.

It has been used as a tonic and alterative in *scrofula* and in *rachitis*, but in the latter disease the phosphates are justly preferred. It may be used in *dyspepsia*, especially in those forms attended with acid eructations, heartburn, and ulcerative stomatitis, due to fermentation of food or excessive secretion of acid by the stomach. In these cases it should be given before meals. It is often added to cough mixtures. As it contains no free phosphorus it should not be given to produce the medicinal effects of that drug. Dose, ♏x–xxx diluted.

ACIDUM LACTICUM—LACTIC ACID.

This acid ($HC_3H_5O_3$) is formed in the souring of milk by the fermentation of its sugar under the influence of casein, between 68°

and 84° F., and is a "syrupy, colorless, or pale wine-yellow liquid, having a slight bland or no odor, a very sour taste, and a sp. gr. 1.212." It is also made by the action of a peculiar ferment on a solution of sugar. The official acid contains 75 per cent. of absolute lactic acid. Lactic acid unites in all proportions with water, alcohol, and ether, but is insoluble in chloroform and carbon bisulphide. In its *effects* it resembles the mineral acids, aiding digestion in small doses, while in large doses it disorders the stomach, causing flatulence and epigastric pain. It is a normal ingredient of the gastric juice, and it seems probable that the acidity of this secretion depends partly upon its presence. At all events, as far as digestion is concerned, it answers equally well with HCl.

Given in large doses and long continued, it has caused rheumatic pains.

It has been *used* in certain forms of *dyspepsia* depending on a deficiency of acid in the gastric juice, as in atonic dyspepsia, apepsia, and irritative dyspepsia, when it is given after meals and frequently combined with pepsin; in *acidity* and *heartburn* it may be given before meals to decrease the secretion of acid. It has also been prescribed for the removal of *phosphatic deposits* in the urine when these depend on disordered digestion. As a solvent for the false membranes of *croup* or *diphtheria* it has been used as a gargle or by atomization. Dose, ♏x–xxx, well diluted.

PHOSPHORUS.

PREPARATION AND TEST.—**Phosphorus** (P), which is never found in a free state in nature, is obtained from the calcium phosphate of *bone-ash*, by removing the lime with sulphuric acid, and afterward deoxidizing the residuum by heating with charcoal. It is a translucent, highly inflammable, nearly colorless solid, resembling wax, without taste, but having a peculiar garlicky smell; sp. gr. 1.830. It is insoluble in water, and dissolves sparingly even in the oils, ether, and alcohol but is soluble in carbon bisulphide. It emits, when exposed to the air, white fumes, which are luminous in the dark. It should be kept under water to prevent combustion. The most delicate *test* for free phosphorus is that of Mitscherlich, which consists in distilling the suspected substance with weak sulphuric acid in a flask and conducting the vapor in a tube through a glass condenser, the tube terminating in a bottle containing water placed under the condenser. That portion of the tube passing through the condenser must be surrounded by cold water contained within the latter, which, if phosphorus be present in the distillate, will condense it, causing a peculiar luminosity to be visible when observed in the dark. The water in the bottle may also be tested for phosphorus.

PHYSIOLOGICAL EFFECTS.—*Locally:* when applied to the skin, phosphorus produces inflammation, ulceration, and even gangrene. The fumes of phosphorus are irritating to the conjunctiva and respiratory mucous membranes, and may produce necrosis of the maxillæ, if the person exposed has caries of the teeth. This form is mostly observed among the artisans of match-factories. Nervous system: in small doses, it is a tonic and stimulant to the nervous system, aiding in the repair of waste. Circulation: phosphorus is absorbed by the blood, according to Bamberger. Either in the stomach or after entering the blood, a portion must unite with oxygen or hydrogen, as the odor of a phosphuretted compound is generally perceptible in the exhaled air of a person taking it. It stimulates the circulation, increasing the frequency and fullness of the pulse, and producing dilatation of the cutaneous capillaries. Large doses depress and weaken the cardiac action. Temperature: this is slightly elevated. Secretion: it increases the urinary secretion and the relative proportion of urea excreted, and gives to the urine an odor of violets. It stimulates the skin and increases the perspiration. In poisoning from phosphorus, albuminuria and hematuria have been observed. Osseous system: it stimulates the formation of bone, especially of the compact tissue, and the proportion of inorganic to organic matter is increased (Wegner*). Elimination: phosphorus passes out of the system by the liver and other glands, by the pulmonary mucous membrane, and by the skin.

TOXICOLOGY.—When taken in large doses, or for a considerable time, phosphorus acts as a gastro-intestinal irritant causing vomiting, purging, abdominal pain, an alliaceous taste in the mouth, the vomited matters and sometimes the stools being phosphorescent. Toward the end the pupils dilate, the abdominal walls are sensitive to pressure, there is great thirst and anxiety, and death may be preceded by convulsions. Hartman,† asserts that the temperature is finally elevated, the feces are of normal color, and the urine contains biliary pigment and acids. Jaundice is a frequent sequela; according to Alter,[*] the pathological changes involved in its production are swelling of the mucous membrane of the biliary passages and hypersecretion of bile—both due to fatty infiltration of the biliary epithelium and followed by absorption of bile. Wolfs,[†] who has studied the post-mortem appearances in sixteen cases, states that the blood is rendered more fluid, coagulation prevented, and the corpuscles altered in form. Vetter,[‡] however, found the latter in normal condition. Hemorrhages take place or form in the serous cavities, especially in the pericardium and pleuræ, due, doubtless, to the changes in the blood and fatty degeneration of the capillaries and arterioles. The liver often becomes atrophied, undergoes fatty degeneration of its cells, as do also the other tissues, notably the muscles. The heart is soft and pale, and the parenchyma and cortex of the kidneys are infiltrated with fat cells. In fact, the ingestion of phosphorus, either in toxic amount or continuously, tends to the production of a general steatosis. Death has been caused by gr. jss–iij; also from swallowing an infusion of matches (Woodman and Tidy).[§] The period when fatal varies from a few hours to seven days.

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* *Virchow's Archives*, 55, p. 11.

† "Zur acuten Phosphorvergiftung," Dorpat, 1866.

ANTIDOTES.—In cases of poisoning, an emetic should be administered at once, preferably copper sulphate repeatedly given in small doses, partly for its emetic action and partly as a chemical antidote, since Bamberger[||] has shown that it forms with this salt a phosphide, thus checking the intensity of its effects. The oil of turpentine, an antidote introduced by Andant,[¶] who exemplified its virtues in the case of a woman poisoned by matches, has been frequently and with success employed against phosphorus (Laboullène,[**] Lecorché,[††] Rommelaere[‡‡]). Personne,[§§] experimenting on dogs poisoned with phosphorus, observed that almost all recovered to whom turpentine had been given. He thought it formed with phosphorus an insoluble mass or inert combination (turpento-phosphoric acid, a spermaceti-like substance). *French acid oil of turpentine*, according to Vetter, (*loc. cit.*) must be administered, and it should be old, as the real antidote appears to be oxygen in the form of ozone contained in oxygenated oil of turpentine. Fats and oils are to be avoided, as they increase the solubility of phosphorus. The after-treatment consists in the exhibition of a brisk cathartic, such as magnesia.

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[*] "Inaug. Diss.," Breslau, 1867.

[†] "Inaug. Diss.," Berlin, 1868.

[‡] *Virchow's Archives*, 53, p 168.

[§] "Forensic Med.," etc., 1882, p. 95.

[||] *Würzburger Medicinische Zeit.*, 1866, p. 47.

[¶] *Bull. Gén. de Thérap.*, 75, p. 269; 76, p. 273.

[**] *Gaz. des Hôp.*, xlvi, p. 361; *Gaz. Heb.*, 1874, p. 524.

[††] *Arch. de Phys.*, t. i, p. 571; t. ii, p. 488.

[‡‡] *Bull. Gén de Thérap.*, 82, p. 145.

[§§] *Bull. Gén. de Thérap.*, 76, p. 353.

MEDICINAL USES.—In suitable doses, phosphorus is a valuable stimulant and tonic to those tissues in which it is normally found, and it has been employed with advantage in cases of *neurasthenia* and degeneration of nerve-tissue, especially in *neuralgia;* though Anstie[*] says its utility is neither extensive nor reliable in the last disease. It is administered with benefit in *rachitis*, *angina pectoris* (attack), in *lymphadenoma*, and has proved useful in some cases of pernicious *anemia.* It is one of the best aphrodisiac remedies we possess in functional *impotence*, and has been given in certain cutaneous affections, as *lupus* and *psoriasis.* The dose of phosphorus is gr. $\frac{1}{30}$–$\frac{1}{12}$. The official preparations are: *pilulæ phosphori* (*phosphorus pills*), each pill contains gr. $\frac{1}{100}$; *oleum phosphoratum* (*phosphorated oil*), a solution of phosphorus (1 part) in ether (9 parts) and almond-oil (90 parts); dose, gtt. v–xx.

Zinci Phosphidum (*Zinc Phosphide*), (Zn_3P_2), prepared by subjecting fragments of zinc and phosphorus together to ebullition in a retort, through which a current of dry carbonic acid gas has been previously passed, has been employed in cases where the administration of phosphorus is indicated. It occurs as a gray, crystallized body, unaltered by moist air, and easily decomposed in the stomach, with the evolution of phosphuretted hydrogen. It has been found efficacious as a nerve-tonic in *hypochondriasis;* also in *eczema*, *psoriasis*, and other cutaneous affections. Dose, about gr. $\frac{1}{20}$–$\frac{1}{4}$.

ORDER V.—ASTRINGENTS.

These are medicines which produce contraction and corrugation of the tissues by a local action. Their constitutional effects are somewhat analogous to those of tonics; and, like them, they increase the tone and vigor of the body, and exercise a control over various disorders of the nervous system. But they are chiefly employed to cure relaxation of the fibres and tissues, to subdue inflammation of superficial parts, and to arrest hemorrhage and excessive discharges from mucous membranes or other secreting surfaces. In checking morbid discharges from the bowels, astringents diminish the secretions from the intestinal canal, and restrain their peristaltic movements, accomplishing this by a local action. They are divided into VEGETABLE and MINERAL astringents. Most of the former owe their astringency to the presence of a principle termed TANNIC ACID, and differ from tonics in the absence of bitterness. The mineral preparations usually classed among the astringents are those of lead, copper, zinc, silver, bismuth and alum, and are distinguished from the mineral tonics by their more decided astringency and a sedative action on the vascular system.

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[*] "Neuralgia," etc., 1871, p. 180.

VEGETABLE ASTRINGENTS.

ACIDUM TANNICUM—TANNIC ACID.

PREPARATIONS AND TESTS.—This acid, which is the active principle of the vegetable astringents, is usually extracted from powdered nutgall by the action of washed ether. The nutgall, made into a soft paste with ether, is enveloped in a canvas cloth, and is pressed between tin-plates; the resulting cake is again mixed with washed ether and expressed; and the expressed liquids are mixed, evaporated and dried; the water seems to be the solvent which extracts the tannic acid. It is a light, feathery, non-crystalline powder, of a yellowish-white color and a strongly astringent taste, is very soluble in water, and soluble, though less so, in alcohol and ether. *Tests.*—It produces a white flocculent precipitate with solution of gelatin, a bluish-black precipitate with ferric salts (ink), and white precipitates with solutions of the vegetable alkaloids; and these substances are to be, therefore, considered *incompatible* with all the vegetable astringents. There is a variety of tannic acid (*mimo-tannic acid*) obtained from kino, catechu, and some other substances, which strikes a *greenish-black* precipitate with the salts of iron, and is not convertible into gallic acid. Tannic acid ($C_{14}H_{10}O_9$) is a glucoside, yielding, besides glucose, gallic acid. Its hydrogen atoms are theoretically replaceable by bases, but the salts are not well defined. The most recent investigators consider tannic to be the anhydride of digallic acid.

INCOMPATIBLES.—With the salts of iron (ferric and ferrous), lead, silver, antimony, the glucosides, and the alkalies, a precipitate is formed; also with gelatin and the alkaloids.

Effects and Uses.—Tannic acid applied *locally* to mucous membranes is a powerful astringent, and is applicable to all the cases in which astringents are useful. It precipitates peptones from watery solutions, but this does not take place in the presence of hydrochloric acid (Lewin). It checks the secretions of the mouth and stomach by constringing the calibre of the vessels, and it restrains intestinal peristalsis. When applied in weak strength to the blood-vessels dilatation ensues, while a strong solution will contract them. Injected into the veins in large amount it coagulates albumen, causing fatal thrombosis. Introduced in the same way, gradually, in moderate quantities, it exist as tannate of albumen, being held in solution by the alkaline carbonates (Lewin). According to Stockman's* investigations tannic acid in the stomach unites with alkalies, and in the intestine is converted into gallic acid; but it cannot be obtained as such, or at best a mere trace, from the blood. Probably the alkaline tannates in the stomach are absorbed at once, and on the amount of this absorption depends the quantity in the urine; for that in the intestine remains there a long while, being scarcely absorbed at all, is converted into gallic acid, and goes off by the bowel. Tannin is excreted in the urine of the rabbit as alkali-tannate, while in man it may be given a long time before it can be detected there with ferric chloride. The remote effects of tannin as an astringent would seem to be valueless; for when its affinities are satisfied in the blood, either with an alkali or albumen, it does not affect the calibre of the vessels nor precipitate albumen. It is used *internally* in the treatment of *hemorrhage*, colliquative *sweats* and in *diarrhœa* and *dysentery* where it is believed to act by forming a protective coating along the intestinal walls, and it is frequently prescribed in the form of tincture of catechu or kino. It is also used as an enema in *diarrhœa*, *dysentery*, *prolapsus ani* and *fissure of the anus*, and, as a *topical* application, in *hemorrhages*, discharges from mucous membranes, as *gonorrhœa* and *conjunctivitis*, (gr. ij–v to aq. f℥j), and *ulcers*, as a nasal wash in *chronic nasal catarrh* (gr. ij–v to aq. f℥), to check the bleeding of *epistaxis*, retained in place with a cotton-wad, as an ointment in *fissure of the nipple*, and as an astringent gargle in *cough* and *pharyngitis*. It is doubtful

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***Brit. Med. Journ.*, Dec. 4th, 1886, p. 1077.

if it possess the power to lessen the urinary albumen in *Bright's disease.* Dose, gr. j–iv, in pill, occasionally repeated. *Troches of tannic acid* are made by rubbing together tannic acid, powdered sugar and tragacanth, and forming a mass with orange-flower water; each troche contains of tannic acid gr. j. *Ointment of tannic acid* (*unguentum acidi tannici*) is made by rubbing up 10 parts of tannic acid with 90 parts of benzoinated lard.

ACIDUM GALLICUM—GALLIC ACID.

PREPARATION AND TEST.—This principle is found in many of the vegetable astringents, but less uniformly than tannic acid, and is probably the result of changes which the latter has undergone. It is prepared by exposing a mixture of nutgall and animal charcoal in water to the air, in a warm place, for a month, when the tannic acid is gradually converted into gallic acid by the absorption of a molecule of water, since the most recent experimenters (H. Schiff, Sac and Löwe) have shown that tannic acid is the anhydride of digallic acid; it is purified by being boiled in water and filtered through animal charcoal. It is also prepared by boiling powdered nutgall in dilute sulphuric acid (Liebig). If the conversion into gallic acid be completed there will be no turbidity on the addition of solution of isinglass. *Test.*—Gallic acid ($HC_7H_5O_5.H_2O$) is distinguished from tannic acid by not coagulating albumen or gelatin; and it unites with organic and inorganic bases to form gallates. For *internal* use, gallic acid is preferable to tannic, since it does not coagulate albumen. It occurs in small silky, nearly colorless crystals, having a slightly acid and astringent taste, and is soluble in boiling water, and slightly so in cold water.

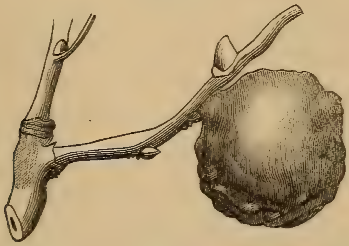
INCOMPATIBLES.—The mineral and organic bases.

EFFECTS AND USES.—Gallic acid is an astringent, of doubtful value, which has been extensively employed in hemorrhagic disorders, as *uterine hemorrhage*, *hemoptysis*, *hematuria*, bloody *diarrhœa*, etc. But according to Stockman (*loc. cit.*) it has no other action than that of a weak organic acid, and only diminishes the alkalinity of the blood. Sodium gallate is without effect on the calibre of the vessels. Both tannic and gallic acids have been employed to diminish the quantity of albumen in *chronic Bright's disease*, but the proof of their utility in this condition is by no means conclusive. Gallic acid has but feeble *local* astringent powers, and is probably converted into tannic acid in the blood. Given by the stomach, it is more efficacious than the latter acid. It may be given in doses of gr. ij–v, in pill, every two or three hours. The *ointment* contains 10 per cent. of gallic acid with benzoinated lard.

GALLA—NUTGALL.

Nutgall is an EXCRESCENCE found upon Quercus lusitanica, *var.* infectoria, the Gall Oak (*Nat. Ord.* Cupuliferæ), a small tree or shrub of Asia Minor. The gall-nuts are produced by the puncture of the buds by a fly (*Cynips quercûs folii* or *Diplolepis gallæ tinctoriæ*) to form a nidus for its eggs. This occasions an irritation and flow of juices to the part, resulting in the formation of a tumor around the larvæ, which, on attaining maturity, perforate the gall and escape. Galls are produced chiefly in Syria and Asia Minor, and are imported from the Levant. They are brought also from Calcutta, being collected to some extent in India. Galls are spherical, about the size of a hickory-nut, with small tubercles on their surface. The best are *bluish* or *black* externally and grayish within, without odor, and of a very astringent, bitter taste. They yield their properties to both water and alcohol, but best to the former, and contain *tannic acid*, 50 to 60 per cent., and *gallic acid*, 3 per cent.; mucilage sugar, etc. *White* galls are collected after they have been perforated by the insect, and are inferior in astringency, containing only 30 per cent. of *tannic* acid.

FIG. 16.



QUERCUS INFECTORIA (NUTGALL).

INCOMPATIBLES.—See tannic acid.

EFFECTS AND USES.—Galls are powerfully astringent, but are not much used *internally*. In the form of infusion or decoction they are employed as enemata in *chronic diarrhœa* and *dysentery*, and also as gargles. Dose of the powder, gr. x–xx. The *tincture* (20 per cent., in glycerin and diluted alcohol) may be given in the dose of fʒj–iij, but it is used chiefly as a chemical test. The *ointment* (10 parts to benzoinated lard 90 parts) is a favorite application in *hemorrhoids*, and may be advantageously combined with opium (ʒss to ointment ℥j).

CATECHU.

Catechu, formerly called Terra japonica, is an EXTRACT of the wood of Acacia Catechu, a small prickly tree of India (*Nat. Ord.* Leguminosæ). Twelve or fifteen varieties of the drug are described by pharmacologists; but it is usually met with in the shops in masses of various shapes and sizes, of a rusty-brown color externally and varying internally from a reddish or yellowish-brown to a dark-brown color. The best is of a dark color, and is easily broken into small angular fragments, with a smooth, glossy surface, bearing some resemblance to kino. It is without smell, and has an astringent bitter taste. It contains about 50 per cent. of *catechu-tannic acid*, which strikes a *greenish black* precipitate with ferric salts, and about 30 per cent. of an acid principle, called *catechin*, to both of which it owes its peculiar properties; also, in small amount, *quercitrin* and *catechu-red.*

INCOMPATIBLES.—See tannic acid.

EFFECTS AND USES.—This is one of the most powerful and valuable of the vegetable astringents, possessing also mild tonic properties. It is much employed in combination with other remedies in *chronic diarrhœa*, *dysentery*, and *hemorrhages*, and is best administered half an hour before meals. It is a good deal used in relaxed conditions of the mouth and throat, to relieve the *hoarseness* of public speakers, also in *aphthous* ulcerations of the mouth and spongy affections of the gums. *Topically*, it is employed as a styptic, and in solution as an injection in *gonorrhœa* and *gleet.* Dose of the powder, gr. x to ʒss in bolus or emulsion.

Of the *compound tincture* (12 parts with cinnamon 8 parts in diluted alcohol to make 100 parts), the dose is fʒj–iij., useful with morphia in *acute diarrhœa.* The *troches* each contain of catechu, gr. j, with sugar, tragacanth, and orange-flower water.

KINO.

The term *Kino* is applied to the products of several trees. Five varieties are known. 1. East India kino, which is the most common, is the INSPISSATED JUICE of Pterocarpus Marsupium (*Nat. Ord.* Leguminosæ), a lofty tree of Malabar. 2. African kino, the original variety introduced into Europe, but not now met with; obtained from Pterocarpus erinaceus. 3. Botany Bay kino, the *concrete juice* of Eucalyptus resinifera (*Nat. Ord.* Myrtaceæ), a large tree of Australia. 4. Bengal or Palas kino, from the Butea frondosa (*Nat. Ord.* Leguminosæ). 5. Jamaica and Caraccas kino, the *extract* of the wood and bark of Coccoloba uvifera, or Seaside Grape (*Nat. Ord.* Polygonaceæ), a small tree of South America and the West Indies.

East India kino* is met with in small, angular, shining fragments, of a dark-brown or reddish-brown color, brittle, without smell, but with a very astringent taste. It contains *kino-tannic acid*, *kino-red*, *pyrocatechin* (a trace), and *kinoïn.*

South American kino comes in large masses, externally very dark, and internally of a deep reddish-brown color.

Jamaica kino resembles the last, but is contained in large gourds.

Incompatibles.—See tannic acid.

Effects and Uses.—Kino is a powerful astringent, and is much used in *chronic diarrhœa* and *dysentery*, *leucorrhœa*, *gonorrhœa*, and *hemorrhages*. *Externally*, it is employed as a styptic, and as a stimulant to indolent *ulcers*. Dose of the powder, gr. x-ʒss; of the *tincture* (10 parts, glycerin 15 parts, alcohol and water to make 100 parts of tincture), fʒj-ij may be given, and it is frequently added to chalk-mixture in diarrhœa.

KRAMERIA.

Krameria or Rhatany is the root of Krameria triandra and of K. tomentosa (*Nat. Ord.* Polygaleæ), shrubs of Peru, Bolivia, and New Granada. It occurs in woody cylindrical pieces, of the thickness of a goose-quill to twice that size—many radicles being often united to a common head. They have a dark, reddish-brown bark, and a tough central ligneous portion, of a lighter red color. They are without smell, but have a very astringent, slightly bitter and sweetish taste, which is much stronger in the cortical than the ligneous portion; and hence the smallest pieces should be preferred, as they contain the most bark. Rhatany yields a large proportion of *kramero-tannic* and *rhatanic-red*. It imparts its properties to both cold and boiling water, but more fully to alcohol.

Incompatibles.—See tannic acid.

Effects and Uses.—Rhatany is powerfully astringent, with some tonic properties. It is much used in the treatment of *chronic diarrhœa*, *dysentery* and *hemorrhages*, and as an enema. Trousseau strongly recommends its use in *fissure of the anus*, and in tenesmus due to *chronic dysentery* or *hemorrhoids;* it is also used in hemorrhoids and *leucorrhœa.* The powdered extract is an ingredient in many tooth-powders, and the tincture is used also as an astringent mouth-wash. Dose of the powder, gr. xx-xxx; watery *extract*, dose, gr. x-xv; *fluid extract*, dose, fʒss-j; *tincture* (20 per cent.), dose, fʒi-ij; and *syrup*, dose, f℥j-iv. The *troches* each contain gr. ij of Krameria with sugar, tragacanth and orange-flower water.

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* For an analysis of Kino, see *Am. Jour. of Phar.*, April, 1889.

HEMATOXYLON.

Logwood, or Campeachy wood, is the HEART-WOOD of Hematoxylon campechianum (*Nat. Ord.* Leguminosæ), a medium-sized tree of Campeachy and other maritime parts of tropical America, and now naturalized in the West Indies. The portion used in medicine, and also as a dye, is the heart-wood, from which the bark and white sap-wood are removed previous to exportation. It is imported in billets of different sizes, of a dark color externally and a deep red internally; in the shops it is kept in chips or raspings. It has a sweetish, astringent taste, and a feeble, not unpleasant, smell. It contains *tannic acid*, a coloring principle called *hematein*, *hematoxylin* ($C_{16}H_{14}O_6$), *resin*, etc.

INCOMPATIBLES.—See tannic acid.

EFFECTS AND USES.—It is a mild astringent, useful in *chronic diarrhœa* and *dysentery*, and particularly well adapted to the weakened condition of the bowels which follows *cholera infantum.* Mothers should be told that the stools of infants taking hematoxylon will stain their napkins red. It is also employed in the diarrhœa of *phthisis.* It is given in decoction in the dose of f℥j to adults, and fʒj to children; or watery *extract*, in the dose of gr. x-xxx in solution.

QUERCUS ALBA—WHITE OAK.

The barks of several species of American oaks possess astringent properties, and are probably to be found in the shops, but the only official variety is Quercus alba, White Oak (*Nat. Ord.* Cupuliferæ). The INNER BARK is the portion used, but the leaves and acorns also are astringent. White-oak bark is distinguished by its whitish color. When prepared for use, it is deprived of its epidermis, and is of a light-brown color and fibrous texture, with an astringent and bitterish taste. Water and alcohol extract its virtues, which depend mainly on the presence of *querci-tannic acid* ($C_{28}H_{24}O_{12}$), *tannin*, *oak-red*, etc.

Effects and Uses.—A decoction of white-oak bark is a good remedy in *chronic diarrhœa* and *hemorrhoids*, and is employed as an enema in *hemorrhoids* and *prolapsus*, and *fissure of the anus*, as a gargle in *relaxation of the uvula*, and as an injection in *leucorrhœa* without inflammation and where the discharge is profuse, in checking which the mineral astringents have failed. It, however, stains the linen.

It is also used on a cotton-tampon in *uterine involution*, and *rectocele* when these conditions are due to relaxation of the parts, or when operative interference is not justifiable. Of decoction of white-oak f℥ij may be taken frequently.

GERANIUM.

One of the most powerful of the *indigenous* astringents is Geranium maculatum, Crowfoot, or Cranesbill (*Nat. Ord.* Geraniaceæ), a perennial herbaceous plant, growing in moist woody situations, with an erect stem one to two feet high, pale-green, mottled leaves, and large purple flowers, which appear in April and May. The part used is the RHIZOME, which should be collected in the autumn. This, when dried, occurs in wrinkled, rough pieces, from a quarter to a half an inch in thickness, furnished with slender fibres, of a dark-brown color externally, and a pale flesh-color within. It has an astringent but not bitter taste, and no smell, and contains *tannic* and *gallic acids* with *mucilage*.

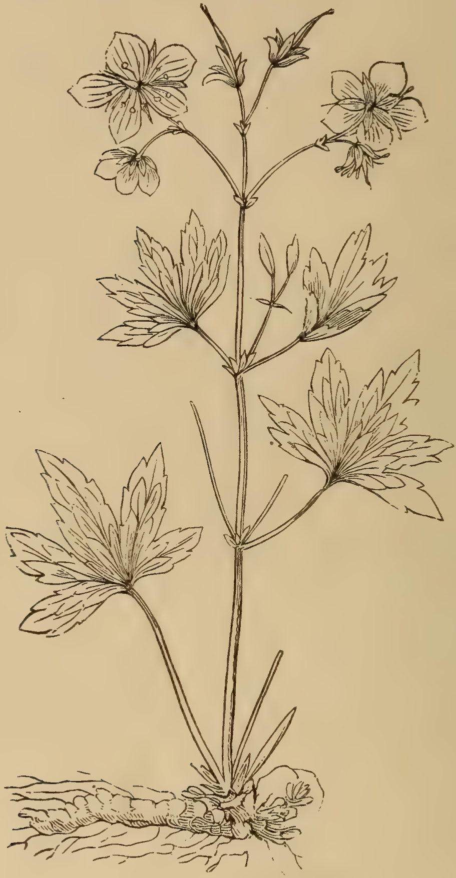
Effects and Uses.—This is an excellent simple astringent, agreeing very well with the stomach, and might be advantageously substituted for the more expensive foreign drugs. It may be used internally to fulfill the indications of kino, rhatany, etc., in bowel complaints and *hemorrhages*, and *topically* as an enema, gargle, injection, etc. It is also a styptic. Dose, in powder, gr. x to xx; of the decoction, f℥j–ij may be given. A decoction in milk is given to children. The *fluid extract* may be taken in doses of fʒss–j.

HAMAMELIS.

Hamamelis Virginica, or Witchhazel (*Nat. Ord.* Hamamelaceæ), is a shrub, from six to ten feet high, growing in the damp woods of the United States and Canada. The LEAVES are the official part, and should be collected in the autumn. They are bitter and astringent. The bark may also be used. Hamamelis contains *tannic acid* (8.10 per cent.), a bitter-principle not yet accurately determined, etc.

EFFECTS AND USES.—Hamamelis is an astringent, and, according to Phillips, possesses probably a hemostatic and shrinking power over veins, especially those of the skin and mucous membranes. It has been used with success in passive *hemorrhages*, in *hematemesis*, *hemoptysis*,[*] and *hematuria*. It is beneficial in *hemorrhoids*,[†] checking the bleeding and reducing the size of the enlarged veins. For this purpose it may be given *internally* and used as an *injection*, beginning with ʒj to water f℥ij, and gradually increasing the strength.

FIG. 17.



GERANIUM MACULATUM. RHIZOME.

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[*] *Bull. Gén. de Thérap.*, cvi, p. 193. Dujardin-Beaumetz. Sur Hamamelis Virginica.

[†] *Ibid.*

The injection should be taken morning and evening, and retained, and it must be continued for some time. It is also recommended *locally* in inflammations and congestions. The *fluid extract* is the only official preparation; dose, f℥ss–j.

The following vegetable astringents deserve notice, though less frequently employed than the foregoing:—

Rosa Gallica (*Red Rose*); **Rosa Centifolia** (*Pale Rose*) (*Nat. Ord.* Rosaceæ). The PETALS of these two species of rose are official, but those of almost every other species of cultivated rose may be employed for the same purpose as Rosa centifolia, which is not astringent. The red rose is a mild astringent. The *fluid extract* is used as a flavoring ingredient in gargles and mouth-washes, and to disguise the taste of other medicines, as Glauber or Epsom salts. The *confection* is used as a basis for pills. *Mel Rosæ* (*Honey of Rose*), made with diluted alcohol and clarified honey, is used as an addition to gargles; the *syrup* is added to mixtures. The pale rose is slightly laxative. *Aqua Rosæ* (*Rose-Water*), distilled from the pale rose, is much employed in collyria, etc. *Unguentum Aquæ Rosæ* (*Ointment of Rose-Water*) is made by melting together oil of almond 50 parts, spermaceti 10 parts, white wax 10 parts, and then gradually adding rose-water 30 parts; this is a very soothing application, much used under the name of *cold cream*. Serviceable when applied to *blistered surfaces*, *chaps* and *lichen*.

Rhus Glabra (*Sumach*). This is an indigenous shrub growing to the height of from four to twelve feet, having a somewhat bent stem "divided into straggling branches, covered with smooth light gray or somewhat reddish bark, and imparipinnate leaves" with from twenty-one to thirty-one lance-oblong, pointed, and serrate leaflets. The FRUIT is in "clusters of small crimson berries which are subglobular, about one-eighth of an inch in diameter, drupaceous, densely haired, containing a roundish-oblong, smooth putamen."

They contain *acid calcium and potassium malates*, *tannin*, *coloring matter*, etc. (Maisch), and are excellent astringents, especially valuable as a gargle in *aphthæ* and other forms of sore mouth and in *pharyngitis*, for which purpose the *fluid extract* may be diluted with two or more parts of water.

Rubus (*Blackberry*). The BARK OF THE ROOT of Rubus villosus, Rubus trivialis and Rubus Canadensis (*Nat. Ord.* Rosaceæ), the former (the common American Blackberry) an erect, prickly shrub, and the two latter (Dewberries) creeping briers, are very efficient mild astringents, which have been used with excellent effect in bowel complaints, especially those of children, particularly *diarrhœa.* The astringency resides principally in the cortical portion, and hence the smallest roots should be preferred. According to Krauss'[*] analysis the root-bark contains an amorphous glucoside, *villosin*, and about 10 per cent. of tannin. The *fluid extract* may be given in doses of fʒj–ij; the *syrup* is made by adding 20 parts of the fluid extract to syrup 80 parts; dose, f℥ss.

CASTANEA (*Chestnut*). The LEAVES of the Castanea vesca (*Nat. Ord.* Cupuliferæ), a stately tree indigenous to both hemispheres, are official. They should be gathered in the autumn while still green. They contain *tannin*, etc., and are used occasionally in *whooping-cough.* Dose of the *fluid extract*, fʒss–ij.

A large number of vegetable substances, both indigenous and foreign, have been used as astringents in addition to those enumerated, the astringent principle being the most common medicinal property with which plants are endowed. The foregoing list comprises the more important.

MINERAL ASTRINGENTS.

PLUMBI PRÆPARATA--PREPARATIONS OF LEAD.

Metallic lead is considered inert. The sulphide and sulphate are probably also inactive; but with these exceptions, all the compounds of lead possess more or less activity. The *tests* for lead are sulphuretted hydrogen and a solution of potassium iodide; the former strikes a black and the latter a yellow precipitate with soluble lead-salts. The editor[†] has ascertained that sulphuretted hydrogen will detect one part of a soluble lead-salt in one million parts of water.

INCOMPATIBLES.—The mineral acids and their soluble salts, the alkalies and alkaline earths, vegetable astringents, opium, potassium iodide, and the sulphides are incompatible with the plumbic salts.

AIDS.—The lead-salts are aided in their depressive action on the circulation by prolonged cold, aconite, veratrum viride, and ergot; in their astringent effects by the salts of zinc, copper, bismuth, and silver, and in their depressing influence upon nutrition by mercury, antimony, copper and the metals which increase tissue-waste.

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[*] *Am. Journ. Pharmacy*, Dec., 1889.

[†] *Am. J. M. S.*. October, 1878, C. Biddle, M.D., U. S. Navy.

Physiological Effects.—When applied *locally* in solutions not too concentrated, they coagulate albumen, contract the blood-vessels, and consequently blanch the tissues, but are not absorbed by the skin.* When more highly concentrated solutions are applied, they act as irritants, producing inflammation. When administered in therapeutical doses, they act as astringents in the alimentary canal, checking secretion and causing constipation. Rutherford states that lead acetate is the only drug which decreases the secretion of the bile without causing purgation, and he attributes this effect to a direct action on the liver. The lead preparations probably enter the blood from the stomach as albuminates, and pass directly to the liver,† by which they are chiefly eliminated, though a trace may be found in the urine. From the intestine they are only slowly absorbed and in small quantity. After absorption they irritate the cardiac inhibitory centre, at the same time acting on the terminal intro-cardiac branches of the vagus, thus diminishing the frequency of the cardiac beat (which under large doses becomes intermittent), lessening the duration of the systolic bruit, and prolonging the diastolic bruit; in this way a diminution in the volume and frequency of the pulse is produced.‡ They also decrease the activity of the secreting functions, and frequently arrest sanguineous discharges, both natural and artificial.

Toxicology and Antidotes.—In excessive doses, several of the saturnine compounds are irritant and corrosive poisons, giving rise to gastro-enteric inflammation, and sometimes to paralysis, coma, and collapse. The toxic dose of lead acetate is ℥j–ij, but it is rarely fatal, owing to the vomiting it produces. The proper *antidote* is sulphuric acid or some alkaline or earthy sulphate, in solution in a large quantity of diluent.

Chronic Lead-Poisoning.—When the system becomes impregnated with lead, either from the too long-continued use of its preparations medicinally, from drinking water drawn through lead-pipes, or from exposure to its influence in lead-factories, etc., a peculiar kind of *chronic poisoning* is produced, which shows itself by a variety of symptoms. The most usual form of lead-poisoning is *colic*, sometimes termed *colica Pictonum*, and *painter's colic*, which is characterized by sharp abdominal pains, with hardness and depression of the abdominal parietes, obstinate constipation, nausea and vomiting. Dr. Ernest Harneck, from experiments on the lower animals, concludes that colica Pictonum is due to intense excitation of the intestinal ganglia by the lead, producing arrest of peristalsis from spasm of the muscular coat, and recommends belladonna or atropine as affording speedy relief. According to Bardenhewer, pilocarpine relieves the colic with equal rapidity. Next in frequency is *lead-arthralgy*, in which there are severe pains in the limbs, attended by cramps, hardness and tension of the painful parts. *Lead-paralysis* is another, though less common, variety of the disease, and is characterized by a loss of voluntary motion, owing to the want of contractility of the muscular fibres of the affected parts. It most frequently affects the upper extremities, and the extensor rather than the flexor muscles. Occasionally, functional *disease of the brain* is also observed as one of the consequences of lead-poisoning. The absorption of lead into the system is recognized by a saturnine coloration of the gums, of the mucous membrane of the mouth, and of the teeth. In a series of experiments made by the editor,* the fact was established that the emanations from fresh lead paint do not contain lead. It seems proven, therefore, that in order to induce saturnine poisoning, actual contact is necessary with paint or lead in some form.

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* *Journal de l' Anatomie et de la Physiol.*, 1873, p. 235.

† *Ibid.*

‡ *Gaz. Hebdom.*, August, 1883, Curci.

THE ANTIDOTAL TREATMENT OF CHRONIC LEAD-POISONING consists in the internal administration of solutions of sulphuric acid and of soluble alkaline and earthy sulphates, and in the use of baths of potassium sulphide, dissolved in warm water, by which the salts of lead, deposited on the skin, are converted into the insoluble sulphide. Potassium iodide is employed as an *eliminative* remedy. For *lead-colic*, a combination of cathartics and opiates has been employed; but the best remedy is alum, in doses of ʒj-ij, every three or four hours, dissolved in some demulcent liquid. In the treatment of *lead-palsy*, strychnine and electricity may be used, but it is a very intractable form of the disease. The use of sulphuric acid lemonade is resorted to by workmen in lead-factories, as a preventive of lead-poisoning. Milk has been found also to answer the same purpose. By passing a strong solution of potassium or sodium sulphide, heated to the temperature of 212° F., through leaden pipes, the interior surface will become coated with an insoluble lead sulphide, and the water distributed through them will be free from contamination.

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* *Am. J. M. S.*, October, 1878, C. Biddle. Prize thesis.

MEDICINAL USES.—The preparations of lead are employed as *astringents*, *sedatives* and *desiccants*. For *internal* use the acetate is almost exclusively employed. It is a most valuable remedy in *hemorrhages*, obstinate *diarrhœa* and *dysentery*, and in the treatment of internal *aneurism* from its combined sedative and astringent influence, and it is also very serviceable in fluxes from the mucous membranes, particularly of the bowels. *Topically*, lead-washes are employed to relieve superficial inflammation, to arrest morbid discharges, and as desiccants. They are objectionable, however, as eye-washes, from their often forming precipitates of lead upon the cornea.

Plumbi Acetas (*Lead Acetate*). This salt ($Pb2C_2H_3O_2.3H_2O$), known also as *saccharum saturni* or *sugar of lead*, is made by immersing lead in distilled vinegar, or litharge in pyroligneous or crude acetic acid. It occurs in colorless, needle-shaped crystals, which effloresce on exposure to the air. They have an acetous odor and a sweetish, astringent taste, and are soluble in both water and alcohol.

EFFECTS AND USES.—The effects of this salt are those of the saturnine preparations which have been already described. Its medicinal influence is sedative and astringent. In *hemorrhages* it is employed *internally*, usually in combination with opium. This combination is also much resorted to in the treatment of *diarrhœa*, *dysentery* and *cholera*, *cholera morbus* and may be prescribed with advantage to arrest the night-sweats of *phthisis*. In the cure of internal *aneurism* the acetate is prescribed alone, but with unsatisfactory results. In *acute diarrhœa*, if there be abdominal pain and frequent serous stools, the acetate should be combined with opium: ℞ Plumbi acetatis, gr. xij; opii pulveris gr. vj. M.S.—Ft. pil. no. vi; one after each stool. This is equally efficacious in *dysentery*, but the proportion of opium should be increased. In *yellow-fever* it is employed to check the hemorrhagic condition of the gastric mucous membrane. It is a dangerous remedy in chronic diseases, from the liability to lead-poisoning, when its administration is long continued. As a *topical* remedy, lead acetate, in aqueous solution, is extensively employed to relieve inflammation and diminish morbid discharges; also in suppository with opium to check *rectal hemorrhage*. *Dose*, gr. j-ij-viij, two or three times a day. When applied to mucous membranes, as in *gonorrhœa*, the strength of the solution may be gr. ss-j or ij to water f℥j; for phlegmonous inflammation, as *boils*, *abscess*, and *prickly heat*, ʒij to water Oj. When it is desirable to combine opium with lead as an external application, the following formula will be found a cheap and efficacious substitute for "lead-water and laudanum:" ℞ Opii pulveris, ʒj; plumbi acetatis, ℥j. S.—Put the powder in a pint of boiling water and stir; when cool apply externally on a cloth of several thicknesses: a serviceable anodyne lotion for *sprains*, *synovitis*, *paronychia*, *phlegmons* and *orchitis*.

Liquor Plumbi Subacetatis (*Solution of Lead Subacetate*). This preparation, frequently termed *Goulard's Extract*, is an aqueous solution of lead diacetate ($Pb_3O_2 2C_2H_3O_2$), and is made by boiling lead acetate and litharge in distilled water. It is a colorless liquid which is decomposed on exposure to the air, with the formation of insoluble lead carbonate, and occasions a dense white precipitate with solution of gum. In other respects it resembles a solution of lead acetate.

MEDICINAL USES.—It is chiefly employed, diluted, to promote the resolution of *external* inflammation and to arrest the discharges from suppurating, ulcerated and mucous surfaces. It is advantageously employed in the moist varieties of *acute eczema*, and also in cases accompanied with much heat. In *orchitis*, solution of the subacetate applied frequently to the scrotum, on lint, together with absolute rest and support of the parts, constitutes an efficient plan of treatment. The official dilution is *liquor plumbi subacetatis dilutus*, commonly known as *lead-water*, and consists of solution 3 parts to distilled water 97 parts. *Ceratum plumbi subacetatis*, or *Goulard's Cerate*, is made by mixing Goulard's extract (20 parts) and camphor-cerate (80 parts); it is an admirable dressing to *excoriated* and *blistered* surfaces, *burns* and *scalds*. *Linimentum plumbi subacetatis* (*liniment of lead subacetate*) is made by mixing cotton-seed oil with Goulard's extract.

Plumbi Iodidum (*Lead Iodide*) (PbI_2) is made by the double reaction of solutions of lead nitrate and potassium iodide. It is a bright-yellow, heavy, inodorous powder, volatilizable by heat, sparingly soluble in cold water, but more soluble in boiling water. It may be given *internally* in the dose of gr. iij–iv, or more, in pill; but it is principally employed *externally* in the form of *ointment* (10 parts to benzoinated lard 90 parts).

Plumbi Nitras (*Lead Nitrate*) ($Pb2NO_3$), made by dissolving litharge in diluted nitric acid, occurs in white, nearly opaque, octahedral crystals, permanent in the air, of a sweet, astringent taste, and soluble in water and alcohol. It may be given *internally*, as a sedative astringent, in doses of gr. ¼–j, twice or thrice daily, in pill or solution. Dr. Fordyce Barker recommends it as an application to *fissured nipples* (gr. x in glycerin f℥j), and the breast must be carefully washed before nursing. *Ledoyen's Disinfecting Fluid* is a solution of lead nitrate ʒj in water f℥j.

Plumbi Oxidum (*Lead Oxide*) (PbO), or *Litharge*, is prepared by blowing air through melted lead, and is obtained also in the process for extracting silver from argentiferous galenas. It occurs in minute yellowish or orange-colored scales, insoluble in water, and is never employed *internally*. It is sometimes sprinkled over ulcers, but its chief use is in the preparation *emplastrum plumbi*, or *lead-plaster* (called also *diachylon*), a lead-soap, which is made by boiling litharge with olive-oil in water, and is, chemically, a mixture of lead oleate and margarate. It serves as a basis for most of the other plasters. *Unguentum diachylon*[*] (*diachylon ointment*) consists of lead-plaster 60 parts melted with olive-oil 39 parts, and incorporated when partly cool with oil of lavender 1 part. This is an excellent soothing application in *chronic eczema* with scales and infiltration, after the parts have been cleansed with sapo viridis, and should be laid on with muslin; it may be equally well applied to *pemphigus*. *Emplastrum saponis* (*soap-plaster*), made by rubbing up soap with lead-plaster, is an excellent discutient; useful in *bed-sores*.

Plumbi Carbonas (*Lead Carbonate*), or *White Lead*, is manufactured in this country by exposing lead to the fumes of vinegar or acetic acid, carbonic acid being derived from the fermentation of tan, in which the pots containing lead are packed; lead oxy-acetate as formed, is converted into the carbonate. It is a white powder, without smell or taste, and insoluble in water, and, as it occurs in commerce, is a compound of lead carbonate and hydrate ($2PbCO_3.Pb2HO$). It is never administered *internally*, but it is employed as a dusting powder—though there is danger of its absorption. *Unguentum plumbi carbonatis* (10 parts to benzoinated lard 90 parts) is a good application to *burns*, etc. White paint is used for the same purpose, but when applied to a large surface it may produce lead-poisoning.

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[*] A better preparation, because more soothing and grateful to the inflamed skin, is that known as *Hebra's Ointment*, which consists of the best olive-oil f℥xv; finely-powdered litharge ℥iij–ʒvi; and water Oj. The water and oil are to be boiled over a steam-bath, the litharge sifted in and stirred, and the boiling kept up till all the particles have disappeared. During this process, 3 or 4 ounces more of water should be added; then stir till cool.

CUPRI PRÆPARATA—PREPARATIONS OF COPPER.

Metallic copper is inert. The *tests* for the soluble salts of copper are: potassium ferrocyanide (which throws down a mahogany-colored precipitate), ammonia (which strikes an azure-blue color), sulphuretted hydrogen, or ammonium sulphide (which throw down a deep brownish-black precipitate), and metallic iron (on which metallic copper is deposited from a cupreous solution).

INCOMPATIBLES.—The sulphides, the alkalies and their carbonates, the mineral salts (except the sulphates), the iodides and vegetable astringents.

AIDS.—See lead.

PHYSIOLOGICAL EFFECTS.—The salts of copper act *locally as caustics*, *irritants*, and *astringents*, by their coagulating action on albumen; applied to the sound skin they produce but little effect. They also constringe the tissues and lessen the blood-supply to a part. In the blood they probably exist as albuminates. Some observers have noted a gain in flesh, in animals and man, after a course of copper. Taken too long they give rise to symptoms similar to plumbic poisoning, viz., constipation, paralysis, etc. When exhibited in small doses, they seem to exert a corroborant influence over the cerebro-spinal system, and are occasionally employed to fulfill the indications to which *tonics* are applicable, as in neuralgia. In larger doses they produce gastric irritation and act as *emetics*. Lauder Brunton * has ascertained experimentally that copper sulphate injected into the blood likewise causes retching and vomiting, probably brought about, he thinks, by irritation of the stomach and intestines, which is reflected to the vomiting centre of the medulla. Copper is eliminated by the liver, intestines, and kidneys.

TOXICOLOGY AND ANTIDOTES.—In excessive doses, they produce gastro-intestinal inflammation and disorder of the nervous system; death, in fatal cases, is usually preceded by convulsions, paralysis, and delirium. In cases of poisoning from the cupreous compounds, the best antidote is *albumen*, as white of eggs, milk, wheaten flour. The *potassium ferrocyanide* is also very efficacious, forming with the cupreous compounds an insoluble copper ferrocyanide.

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* *St. Bartholomew's Hosp. Reports*, XII, p. 145.

Medicinal Uses.—The salts of copper are employed therapeutically, both as external and internal remedies; *externally* as *stimulants*, *astringents*, *styptics*, and *caustics; internally* as *emetics*, *astringents*, and *tonics*.

Cupri Sulphas (*Copper Sulphate*). This salt, known as *blue stone* and *blue vitriol*, is obtained by roasting the native sulphide, or by combining cupric oxide (CuO) and sulphuric acid. It is *cupric sulphate* ($CuSO_4.5H_2O$). It occurs in fine prismatic blue crystals, which, by exposure to the air, effloresce slightly and become covered with a greenish-white powder. It has a styptic, metallic taste, is entirely soluble in water, but insoluble in alcohol. As an *astringent*, it may be given in doses of gr. ¼ to j, or more, in pill, repeated so as not to occasion vomiting, and will be found extremely valuable in the treatment of *chronic diarrhœa*, *dysentery*, and *enteritis*. It is also used as an antidote to phosphorus. As an *emetic*, the dose is gr. iij to v, or even more in *narcosis*. *Externally*, it is used as a mild escharotic to *trachoma*, *condylomata*, and *ulcers*, and in solution to arrest *hemorrhages* and muco-purulent discharges, as *gonorrhœa*. In gonorrhœa gr. ½–j to water f℥j is a suitable strength to begin with.

Cupri Acetas (*Copper Acetate*) ($Cu_22C_2H_3O_2.H_2O$) occurs in deep, bluish-green or green rhombic prisms. The dose is gr. ⅛ to gr. ¼. It resembles the sulphate in its effects and uses.

ZINCI PRÆPARATA—PREPARATIONS OF ZINC.

Zinc in its metallic state is inert. The *test* for soluble zinc salts is ammonium sulphide, which throws down a white sulphide (the only white sulphide met with).

Incompatibles.—The sulphides, the alkalies, fixed and volatile, silver nitrate, the vegetable astringents, and the acids. Between zinc sulphate and lead acetate a double decomposition takes place, not, however, interfering with its local effect.

Aids.—Remedies aiding copper and lead (q. v.)

Physiological Effects.—Its compounds are very analogous in their effects on the system to those of copper, but are less energetic. *Topically* some of the zinc salts (nitrate, chloride) act as powerful caustics, by reason of their affinity for water and power of coagulating albumen. The soluble zinc salts (sulphate, chloride) are readily absorbed, and probably exist in the blood as albuminates, while the insoluble salts (oxide, carbonate) are slowly taken up by the blood. Zinc is eliminated from the system by the bile, intestines, and urine. In cases of poisoning (rare), albumen, demulcents, and opiates are to be administered.

MEDICINAL USES.—The zinc preparations are *employed topically* as *caustics*, *astringents*, and *desiccants;* and *internally*, as *tonics*, *astringents*, and, in large doses, as *emetics*.

Zinci Sulphas (*Zinc Sulphate*) (*White Vitriol*) ($ZnSO_4.7H_2O$) is prepared by dissolving zinc in dilute sulphuric acid. It occurs in small colorless, transparent, prismatic crystals, resembling those of magnesium sulphate. They have a metallic, astringent taste, are soluble in water and insoluble in alcohol, and produce their astringent effect by condensing the tissue and contracting the blood-vessels. *Internally*, it is chiefly used in *chorea* and by Hammond in large doses (gr. ij–xx, t. d.). Dose, as a *tonic* and *astringent*, gr. j to v; as an *emetic* (acting by gastric irritation), it is the promptest and safest that can be given in cases of *narcotic poisoning*, in the dose of gr. x–xx, well diluted in water. It is a suitable astringent for the treatment of obstinate *chronic diarrhœa* and in *enteritis* with profuse stools. *Externally*, it is much used as a caustic, and in solution as a collyrium in *conjunctivitis*, as an astringent nasal wash in *chronic nasal catarrh*, and in *gonorrhoœa*, *gleet* and *urethritis*, in the strength of gr. j–ij–iij to water f℥j; in *otorrhœa*, gr. v. to water f℥j.

Zinci Oxidum (*Zinc Oxide*) is made by roasting zinc in the air. This is an impure form, known as *Commercial Zinc Oxide* (*Zinci Oxidum Venale*), sometimes called *tutty*. A purer form is obtained by exposing precipitated zinc carbonate to heat, which expels the carbonic acid and water. It is a yellowish-white powder (ZnO), insoluble in water, but soluble in diluted sulphuric and hydrochloric acids. It is occasionally used in the treatment of *epilepsy;* dose, gr. ij, in pill, gradually increased. It is now mostly employed *externally* as a dusting powder, and often combined with starch and applied in the early stage of *acute eczema*, and to *pemphigus*, or in the form of *ointment* (20 parts to benzoinated lard 80 parts). This ointment has a wide range of usefulness, it being serviceable in *bed-sores* to keep the parts supple, in *chilblain* as a soothing application after puncture of the blebs, as a simple dressing to *herpes* and *herpes zoster*, *roseola*, *sycosis*, *intertrigo*, *impetigo* and *erythema*.

Zinci Acetas (*Zinc Acetate*) is made by heating commercial zinc oxide in a solution of acetic acid and distilled water, and occurs in white micaceous crystals ($Zn2C_2H_3O_2.2H_2O$), very soluble in water, and efflorescent in dry air. It is used chiefly as a *topical* astringent in *ophthalmia*, *gonorrhœa*, *gleet* and *leucorrhœa*, (ʒj to tepid water Oj) in the proportion of gr. ij to vj, or more, to water, f℥j. As an injection in the third stage of gonorrhœa, it was the remedy preferred by Bumstead,* and its strength should be regulated just short of irritation of the urethra.

Zinci Carbonas Præcipitatus (*Precipitated Zinc Carbonate*) is obtained by the double reaction of solutions of zinc sulphate and sodium carbonate. It is a soft, white powder, a mixture of carbonate and hydrate $(ZnCO_3)_2.3Zn(HO)_2$, similar in its action to the oxide, but is chiefly used as a dusting powder, and to make a mild astringent and desiccant cerate (ʒj to ointment ℥v).

Liquor Zinci Chloridi (*Solution of Zinc Chloride*) may be used to disinfect water-closets and sinks. The evaporation of this solution yields

Zinci Chloridum (*Zinc Chloride*) ($ZnCl_2$), a whitish-gray, semi-transparent, deliquescent mass, having the softness of wax, and soluble in water, alcohol and ether. Its *local* action is that of a powerful caustic, and it is one of the best escharotics that can be exhibited, to produce healthy granulations in malignant or indolent *ulcers*, especially in *lupus*. It may be used as a lotion in the strength of gr. ij to f℥j of water, or dissolved in a little alcohol, or in the form of paste, made with one part of the salt to two or four of flour. A solution of zinc chloride is employed as an antiseptic, and is also injected into the blood-vessels of anatomical subjects to preserve them for dissection. Burnett's Disinfecting Fluid is a solution of about gr. cc in water f℥j.

Zinci Iodidum (*Zinc Iodide*) (ZnI_2) is made by digesting an excess of zinc with iodine diffused in water. It occurs in the form of a white deliquescent mass, or of fine needles, of a metallic, styptic taste, very soluble in water. *Externally*, it is a most valuable local stimulant and escharotic, equal if not superior in effect to the chloride, and is much used.

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* "Venereal Diseases," 1879, p. 59. Bumstead and Taylor.

Zinci Valerianas (*Zinc Valerianate*) ($Zn2C_5H_9O_2.H_2O$) is prepared by the double reaction of sodium valerianate and zinc sulphate. It occurs in white, pearly scales, having a faint odor of valerianic acid, and a metallic, styptic taste. It dissolves in 100 parts of water and 40 of alcohol. Used in *epilepsy* and nervous affections, in the dose of gr. i–ij, repeated several times a day, in pill or capsule.

ARGENTI PRÆPARATA—PREPARATIONS OF SILVER.

INCOMPATIBLES.—The salts of silver form white curdy precipitates with the chlorides and hydrochloric acid; with solutions of potash and soda they yield a brown argentic oxide; with the oxides and bromides yellow deposits are obtained, and with many of the organic acids they afford insoluble compounds, Silver nitrate is reduced by organic matter to an oxide, becoming blackened; the extracts of opium and hyoscyamus are said not to produce this effect.

AIDS.—The copper, lead and zinc preparations enhance the effects of the silver-salts.

In the metallic state, silver is wholly inert. The only preparation which is extensively employed is

Argenti Nitras (*Silver Nitrate*). This salt ($AgNO_3$) is obtained by dissolving silver in diluted nitric acid. It is anhydrous, and occurs in transparent, colorless, shining, heavy, rhombic plates, which have a strongly metallic and bitter taste, and are wholly soluble in distilled water.

PHYSIOLOGICAL EFFECTS.—The *topical action* of silver nitrate to mucous membranes is that of a caustic, by reason of its coagulative action on albumen. This action does not extend deeply, since a superficial protecting pellicle is formed. When moistened and applied to the skin, a white stain is formed, which soon becomes black on exposure to light, by reduction of the silver to the metallic state. *Internally.*—Nervous system: in animals, hypodermic injections of silver hyposulphite and albuminate have caused paraplegia. In small doses, tetanic excitement, and in toxic, convulsions, were produced. On man the argentic salts have caused vertigo, loss of memory and nervous depression. The effects of silver on the nervous system are centric and not peripheral. Circulation: the intravenous injection of the silver-salts impairs the coagulability of the blood, which is found to be dark and pitchy in color.

Other symptoms noted by this method were probably due to the production of embolism and thrombosis. The silver-salts do not exert a toxic influence on the heart. They have a metallic, styptic taste. Small doses (oxide, gr. ¼, nitrate, gr. ⅛) may be taken with considerable impunity by the stomach. But, in excessive quantity (of nitrate, gr. iij–v), it is apt to occasion gastro-enteric irritation, with disturbance of the nervous system; and in these cases the *antidote* is *common salt* (sodium chloride), or any inert chloride, which produces, when in contact with the nitrate, sodium nitrate and silver chloride. Silver nitrate has been thought always to undergo conversion into a chloride in the stomach; but more probably it unites with albuminous matters, which render it soluble. In medicinal doses, it has a corroborant action on the nervous system; and, after prolonged use, since its elimination takes place *slowly*, produces a peculiar indelible *blueness* or *slate color* of the true skin (*argyria*), due to a deposition of the metal in the tissues. This, it has been asserted, is preceded by a peculiar blue line on the gums, resembling that produced by lead-poisoning. Prolonged use of the silver-salts (in animals) causes a marked loss of weight. Elimination takes place by means of the bile, kidneys (chiefly) and intestines.*

MEDICINAL USES.—*Internally*, silver nitrate has been employed in the treatment of *epilepsy*, but it is much inferior to the bromides in the treatment of this intractable affection; and its effect in discoloring the skin is an objection to its protracted use. It is used also successfully in *locomotor ataxia*, being especially extolled by Rosenthall, Charcot, and others, in the dose of gr. ¼, t. d.; but in this disease the galvanic current, in addition to medicines, renders important aid. It has been prescribed, too, in that intractable condition called *spinal sclerosis*. In *gastric ulcer* and *chronic gastritis* it is also efficacious in small doses in pill-form, after the stomach is afforded rest by liquid diet, preferably with milk. As an astringent in *chronic dysentery* and *diarrhœa*, combined with opium its exhibition may prove serviceable. But it is as an *external agent* that it is most resorted to. It is one of the best applications that can be made to inflamed mucous membranes, and, either in the solid form or in solution, it is employed in every variety of inflammation of this tissue. It is also extensively used to produce healthy granulations in *trachoma*, *wounds* and *ulcers;* to arrest the progress of *erysipelatous* inflammation, and the pustules of *small pox;* in *porrigo* and other skin diseases. The strong injections of silver nitrate, formerly used to abort acute *gonorrhœa* being extremely painful, are now rarely resorted to. In this disease, either of the male or female urethra, the best results are obtained by using solutions of the strength of gr. ¼–j–ij, to water f℥j, care being taken to avoid staining the clothing with it. As a collyrium it is contraindicated when ulcer of the cornea exists, for fear of forming an opacity. If a strong collyrium be used (gr. v–x to water f℥j), in *conjunctivitis*, either *simple* or *granular*, or in *ophthalmia*, *gonorrhœal* or *non-specific*, for the relief of which it is an excellent application, the effect on the conjunctiva should be counteracted by flushing it out with a weak solution of salt and water, or even with cold water alone. Topical applications of solution of silver nitrate gr. v–x to water f℥j, applied with a sponge, are highly serviceable in *acute pharyngitis*, and *tonsillitis*, and to the post nasal space in *acute* and *chronic nasal catarrh*. When thus employed, if there be much phlegm about the part, it should be cleansed with Dobell's solution prior to the application of the silver. Silver nitrate stains can be removed by moistening the spot with tincture of iodine and then washing it with solution of sodium hypophosphite. It may be used to destroy the *virus of poisoned wounds*, but its action as a caustic is too superficial to be of much service for this purpose.

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* *Journal de l'Anatomie et de Physiologie*, 1873, p. 289.

Administration.—The dose of silver nitrate internally is gr. ⅙, gradually increased to gr. ½ or j. t. d., in pill, made with Fuller's earth and petroleum mass, and given soon after a little light food has been taken. For *external* use, solutions are made of various strengths, from gr. ij–ʒss or more in f℥j of distilled water, and the bottle should be protected by blue paper from the reducing action of light. An ointment is also employed.

Argenti Nitras Fusus (*Moulded Silver Nitrate—Lunar Caustic*). For *external* use, in the solid form, silver nitrate is melted and poured into small moulds.

Argenti Nitras Dilutus (*Diluted Silver Nitrate*) consists of 50 per cent. each of silver nitrate and potassium nitrate. It is used *externally*.

Argenti Oxidum (*Silver Oxide*) (Ag_2O) is obtained by adding solution of potassa to a solution of silver nitrate. It is a tasteless, olive-brown powder, very slightly soluble in water. Its action and applications are analogous to those of the nitrate, and it is considered to be free from liability to discolor the skin. Dose, gr. ss–j, twice or thrice daily in pill. Used in *pyrosis.*

Argenti Iodidum (*Silver Iodide*) (AgI) may be used in gastric and uterine affections instead of the nitrate. It is also said to have some alterant effects. Dose, gr. j–ij.

BISMUTHI PRÆPARATA—PREPARATIONS OF BISMUTH.

INCOMPATBILES.—The bismuth-salts being insoluble can not be prescribed with other agents in solution.

AIDS.—Morphia and tannin enhance the astringency of the bismuth-salts; calomel and pepsin its sedative influence upon the gastro-intestinal tract. With these agents it may be prescribed either in capsule, powder, or lozenge.

Metallic bismuth is inert. The salts are very insoluble, but to a slight extent are absorbed and eliminated* slowly, as bismuth has been found in the urine,† blood, etc., after their administration. The unabsorbed residue, passing down the alimentary canal, is converted into a sulphide and colors the stools black. The *test* for a bismuth salt is to concentrate it in acid solution and then pour this into wăter when a white precipitate falls, insoluble in tartaric acid.

Bismuth Subnitras (*Bismuth Subnitrate*). This salt is prepared by forming bismuth nitrate by dissolving bismuth in diluted nitric acid, suitable means at the same time being taken to get rid of arsenical contamination, as metallic bismuth usually contains arsenic. Bismuth subnitrate, known as *pearl white* and *magistery of bismuth* ($BiONO_3.H_2O$), is a white, inodorous, tasteless powder, insoluble in water.

EFFECTS AND USES.—Its medical properties are *tonic*, *sedative* and *astringent.* It is used chiefly to allay *nausea* and check vomiting in chronic affections of the stomach, as *ulcer*, *gastric cancer*, *gastric catarrh*, *gastro-intestinal irritability* and *gastrodynia*, in which gr.xv.–xx should be given t. d., in order to obtain its effects. It is also much employed as an astringent in *acute* and *chronic diarrhœa.* As bismuth exerts its astringent influence on the intestinal tract by a local protective action, in the diarrhœa of adults it may be given, advantageously, in large doses (ʒss–j), to be taken one hour before each meal. It is particularly useful in any form of diarrhœa where the stools contain mucus; and *acute diarrhœas* occurring during the summer season are also frequently benefited by it. The following combination is of great service: ℞ Morphinæ sulphatis, gr. ½–j; bismuthi subnitratis, ʒj–ij; sodii bicarbonatis, ʒj; sacchari lactis (seu pulveris cinnamomi), ʒij. M. et div. in chart. xii. Sig.—One powder after each alvine dejection. It is often advantageously given suspended in an emulsion of castor oil with laudanum, in these and similar complaints. It is one of the numerous remedies for *pyrosis*. Dose, gr. v–xx, or even ʒss, in powder or pill. *Externally*, it is a good remedy in skin diseases as *acute eczema* in the form of ointment. ℞ Bismuthi subnitratis, ʒij; zinci oxidi, ʒ½; glycerini, fʒjss; acidi carbolici liquidi, ♏xx; vaselini albi, ℥vi, M. S. Ft. ungt. Mixes into an enamel-like cream. The following forms a good antiseptic application in the treatment of *ulcers* and certain skin affections, as *impetigo*: ℞ Iodoformi, ʒj; acidi borici, ʒij; bismuthi subnitratis, ʒiv; petrolati, ℥ij. M. Sig.—Ft. ungt. It is also well combined with camphor as a dusting powder, to *intertrigo*, or with boracic acid in the treatment of purulent *otorrhœa* of the external auditory meatus.

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* *Journal de l'Anatomie et de la Physiologie*, 1873, p. 243.

† *Transactions* Am. Neurological Association. 1883, p. 24.

Bismuthi Subcarbonas (*Bismuth Subcarbonate*)—($Bi_2O_2CO_3.H_2O$) is recommended as a substitute for the subnitrate. It is thought to be more readily tolerated by the stomach, and is more soluble in the gastric juice, but it is less astringent. Dose, gr. v–xx, or even ʒss, in powder or pill.

Bismuthi et Ammonii Citras (*Bismuth and Ammonium Citrate*), which occurs in glossy, translucent, colorless scales, of a slightly acid, metallic, but not disagreeable taste, very soluble in water, is a good preparation as an astringent. It is much more astringent than the insoluble preparations, but is more irritant; dose, gr. ij.

The *valerianate* (not official) has been used in *neuralgia;* dose, gr. ½–j, several times a day, in pill.

CERII OXALAS—CERIUM OXALATE.

This salt ($Ce_2(C_2O_4)_3.9H_2O$) is usually made by adding a solution of ammonium oxalate to any soluble salt of cerium, and is obtained also from the mineral *cerite*. It occurs as a snow-white, granular powder, inodorous and tasteless, insoluble in water, alcohol, and ether, but dissolved by sulphuric acid. It resembles the salts of bismuth in its effects, and has been deservedly extolled in obstinate forms of vomiting, especially the *vomiting of pregnancy.* In *chorea* and other neuroses it is also highly recommended. Its physiological action has not been investigated. Dose, gr. j. t. d., or oftener, in pill or suspended in water. The *cerium nitrate* has been also employed, and is more soluble. Dose, somewhat less.

ALUMEN—ALUM.

Incompatibles.—The alkalies and their carbonates, the salts of the acidulous radicals, lime-solution, magnesia and its carbonate, potassium tartrate and lead acetate are incompatible with alum.

Aids.—It is aided in its action by the vegetable and mineral astringents.

Alum is a double salt, an aluminium and potassium sulphate ($K_2Al_24SO_4.24H_2O$). It is manufactured from aluminous schist, and sometimes by the direct combination of its constituents. It crystallizes in regular octahedrons; but is commonly found in the shops in large, colorless transparent crystalline masses, without any regular form. It has an astringent and sweetish, acid taste; by exposure to the air it slowly effloresces; it is soluble in cold water, and more so in boiling water; and when heated it undergoes the watery fusion, swells up, and gives out its water of crystallization, and is converted into a white, spongy mass called *dried alum.*

Besides the potassium alum, there are varieties in which the potassium is replaced by some other base, as ammonium or sodium; the official alum was formerly the aluminium and ammonium sulphate, but this has been superseded by potassium alum.

Physiological Effects.—The immediate *topical* effect of alum is that of a powerful astringent, in virtue of a chemical action on the tissues. When it is applied to a part in large quantities, the astriction is soon followed by irritation; and thus, taken internally in excessive doses, it gives rise to vomiting, griping, purging, and even inflammation of the gastro-enteric mucous membrane. After its absorption it acts as an astringent on the system generally, producing constriction of the tissues and fibres, contraction of the capillaries, and a diminution of secretion. It is eliminated chiefly with the feces. After large doses, Orfila detected it in the urine of dogs. Death has resulted in man from dried alum ℥jss.

Medicinal Uses.—Alum is employed *internally* in *hemorrhages, chronic diarrhœa*, and it is sometimes combined with cubeb in the treatment of *gleet* and *gonorrhœa*, as in the following prescription:

℞ Pulveris aluminis, ʒj ; pulveris cubebæ, ℥iv ; pulveris cinnamomi, ℥ss. M. et Sig.—Tablespoonful in half a glass of water 3 times a day ; an efficient mixture when it does not disorder the stomach. Alum is also used as an injection in *leucorrhœa*. It has, too, been given as an emetic in *croup*. Its use in lead-colic has been alluded to. As a *topical* remedy it is valuable as an astringent-antiphlogistic in *ophthalmia*, *diphtheria*, and *tonsillitis ;* to produce contraction of the tissues, in *relaxation of the uvula*, *prolapsus ani*, *uterine involution*, *rectocele*, and it is used as a vaginal injection where the tissues become lax from wearing a pessary ; as a styptic in *hemorrhages ;* and to arrest excessive secretion from the mucous surfaces. In *hemoptysis* and *chronic bronchitis*, a strong solution of alum may be applied to the larynx by atomization. Topically, it is employed in the form of solution, and is useful in *trachoma*, *conjunctivitis*, and as an injection in *gonorrhœa*, attended with profuse discharge, gr. ij-vj to water f℥ij ; in *leucorrhœa*, ʒj to tepid water Oj. In the treatment of pharyngeal *cough* and *pharyngitis* the throat may be swabbed with an alum-solution. An alum-lotion is a good application to *fissure of the nipples*, and as a gargle in *mercurialismus*.

ADMINISTRATION.—*Dose*, gr. x-xxx, in powder or solution, or made into pills with some tonic extract, and combined with an aromatic, as nutmeg, to prevent nausea. It may be agreeably given in the form of *whey*, prepared by boiling ʒij with milk Oj, and straining, of which the dose is f℥ij. *Dried alum* (*alumen exsiccatum*) is employed *internally* in the dose of gr. v-x, and *externally* as a mild escharotic.

Aluminii Sulphas (*Aluminium Sulphate*) ($Al_2 3SO_4.18H_2O$) is employed *externally* as an astringent and antiseptic application to *ulcers*, and as an injection in *gonorrhœa*. The aqueous solution is used to preserve bodies for dissection.

ALUM-WATERS.

Churchill Alum (*Virginia*). One U. S. gallon contains magnesium sulphate, gr. 86 ; calcium sulphate, gr. 88 ; ferric sulphate, gr. 51 ; aluminium sulphate, gr. 72, and silica, gr. 10.

Bath Alum-Springs (*Virginia*). Analyst A. A. Hayes : Contains in one U. S. gallon alumina, gr. 12 ; ferrous sulphate, gr. 22 ; with small quantities of the earthy and potassium sulphates.

Rockbridge Alum-Springs (*Rockbridge County*, *Virginia*). There are 3 springs, the one containing the most alumina yielding gr. 3 to the pint. They are astringent and styptic.

Cresson Springs, of Pennsylvania, contain aluminium sulphate, gr. 21; and ferrous oxide, gr. 16 to the U. S. gallon.

The alum-waters are applicable to the treatment of affections in which the aluminium preparations are prescribed, as *chronic diarrhœa* and *dysentery*. They are particularly useful where iron is indicated.

ORDER VI.—STIMULANTS.

Stimulants are medicines which produce a rapid and temporary exaltation of the vital functions. Their influence is most conspicuous in conditions of morbid depression, when a marked tolerance of their action is established, and large amounts are borne. In health, when the powers of the system are at the normal standard, stimulants soon induce depression. *Topically*, they irritate and inflame the parts to which they are applied, and hence are classed with *irritants*.

Stimulants are employed principally in disorders known as asthenic, and in all conditions of the system attended with exhaustion. From their action in arousing the energies of the nervous system, they exercise a control over many nervous disorders, particularly those of a spasmodic nature. They are also frequently given with a view to their action on some one or other of the secretions. As stimulants to the gastro-intestinal canal, they are administered to promote digestion (when they are called *stomachics*) and to dispel flatulence (when they are known as *carminatives*). *Topically*, they are employed as *rubefacients* and *vesicants*.

The more powerful and rapid stimulants are called *diffusible*. In overdoses, they act as violent narcotics and sedatives. The diffusible stimuli usually employed are vinous and spirituous liquors and the preparations of ammonia. Vegetable stimulants which contain a volatile oil are termed *aromatics*, and are usually given as stomachics, and carminatives. The volatile oils are also employed as local irritants.

DIFFUSIBLE STIMULANTS.

ALCOHOL.

Alcohol is a product which results from a process termed the vinous fermentation, in substances containing grape-sugar. At a temperature of 80° F., the presence of a fermenting body converts a solution of grape-sugar into alcohol and carbonic acid. Starchy substances, being convertible into grape-sugar, also yield alcohol.

Alcohol is obtained from vinous or fermented liquors by repeated distillation. It is, chemically, an ethyl hydrate (C_2H_5HO). Official alcohol should be of the sp. gr. 0.820. It is a colorless, inflammable liquid, wholly vaporizable by heat, and unites in all proportions with water and ether. Contamination of fusel oil or amylic alcohol may be detected by agitation with concentrated sulphuric acid, when, if the alcohol become colored, the presence of the impurity is indicated in proportion to the depth of the color; or solution of silver nitrate, with exposure to a bright light, will convert fusel oil into a black powder.

AIDS.—As a cerebral stimulant, ether, cocaine, cannabis Indica; as a cardiac excitant nux vomica, ammonia and atropia.

CONTRAINDICATIONS.—Chronic hepatic, heart and renal disease, atheroma of the vessels, tendency to obesity, and alcoholic dypsomania.

PHYSIOLOGICAL EFFECTS.—Alcohol * is the intoxicating ingredient of all vinous and spirituous liquors.† *Locally*, alcohol acts as an astringent by hardening the albumen and condensing the tissues. It evaporates rapidly, causing a feeling of coolness. When evaporation is prevented, it acts as an irritant (due to absorption and paralysis of the cutaneous vessels), and may even produce inflammation. When inhaled it may produce anæsthesia, stupor and death. Nervous system: when taken *internally*, in small doses, it stimulates the cerebral hemispheres, possibly by the hyperemia induced; in large doses it causes excitement with impaired coördination of ideas; and in excessive doses it produces coma. Small doses stimulate the spinal cord, while larger amounts weaken the centers governing automatic motion and coördination, and lessen the sensibility of the cutaneous nerves, especially that of the fifth pair of cranial nerves. Large doses paralyze the vaso-motor nerves, giving rise to dilatation of the arterioles, flushing of the surface, and sensations of heat. In inflammatory diseases, medicinal doses contract the arterioles by giving tone to the vaso-motor system, and prevent the migration of white corpuscles (Farquharson). In toxic doses, the nervous centers are involved in the following order: 1. The gray matter of the convolutions and the higher functions of animal life (shown by disordered intellection). 2. The basic ganglia (shown by disordered sensation and motion). 3. The cerebellum (shown by disordered equilibration. This may be in part due to impairment of the muscular sense). 4. The spinal centres (shown by anæsthesia of the lower limbs, extending to the upper limbs and body, difficulty in performing automatic acts, impaired coördination, etc.). 5. The medulla oblongata (shown by labored breathing, and finally death from apnœa). Circulation: alcohol at first stimulates, but afterward depresses the cardiac motor ganglia. In small doses it increases the frequency of the cardiac beat, without affecting the force or rhythm, increasing the rapidity of the contraction and shortening the diastole (Parkes and Wollowicz), and also elevating the arterial tension. This is soon followed by slowing of the heart and lowered arterial tension, and if the dose has been excessive, by weak and irregular contraction. Large doses depress and paralyze the cardiac muscle. Respiration is at first quickened, but afterward slowed. In alcohol-narcosis the breathing is very slow, and death may result from apnœa. Temperature: small doses slightly elevate the temperature. If large amounts have been taken, the temperature is depressed, owing to the radiation of heat from the dilated cutaneous vessels, to lessened oxidation of tissue, and, in alcohol-narcosis, or in the case of animals, to muscular inactivity. The power of resisting cold is lessened by the habitual ingestion of alcohol. Secretion: the secretions are at first increased, then diminished. Alcohol diminishes the quantity of urea, uric acid, sodium chloride, phosphoric and sulphuric acids excreted in the urine, and augments the urinary flow. Sugar is sometimes found in the urine after the ingestion of alcohol. Small doses stimulate the liver, while larger amounts alter the quality of the bile, which may be profuse or scanty. The amount of carbonic acid exhaled from the lungs is diminished. Stomach: alcohol is rapidly absorbed from the stomach, so quickly indeed that upon a person unaccustomed to its use it produces stimulating effects almost at once; small doses increase the flow of the gastric juice by the production of hyperemia about the tubules, and thus excite the appetite and favor digestion. Large doses check the gastric secretion, precipitate the pepsin, and cause anorexia and nausea. When taken habitually, it produces a slow interstitial inflammation of the mucous membrane with hyperplasia of the connective tissue-elements, which, contracting, compress the gastric glands. The secretion will then be much diminished, and the mucous membrane covered with a ropy, glairy mucus. Blood: alcohol must be in a certain state of dilution before it can be absorbed. It is said to precipitate the albumen in the blood, but it must be in a condition too diluted to accomplish this, nor are the consequences of an occasional indulgence sufficiently serious to warrant this statement. It diminishes the power of the red corpuscles to carry oxygen, and when taken continually alters the composition of the blood by its effect on the liver and digestion. Fat in the blood of drunkards is increased from 8.65 parts to 11.7 parts per 1000 (Lecaun). Scharlau found 30 per cent. more carbon in the blood of drunkards than in that of healthy persons. This is due to the avidity with which alcohol combines with oxygen, preventing the oxidation of the hydrocarbons. Muscular system: the muscular power is weakened and the muscular sense diminished. Elimination: alcohol is eliminated unchanged in small proportion to the quantity ingested, by the kidneys, lungs, and to a slight extent by the skin, and probably by the liver, traces having been detected in the bile by Dr. Percy. A portion of the alcohol (about f℥iij) disappears in the system, being probably oxidized, for Anstie,* in a series of elaborate experiments on dogs, was able to recover only about one-fourth of the amount administered. The economy seems to be able to consume this quantity daily, storing it up as potential energy, anything above this being carried away under another form by the eliminating organs. Though f℥iij may disappear in the system, yet it is not to be considered as contributing at all to the normal support of the body. Experience gained in Arctic voyages proved that alcohol was totally unnecessary as an article of diet, and that tea as a restorative stimulant was a much better substitute.

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* Alcohol considered chemically, physiologically, medicinally and as a cause of disease. Essay awarded the Henry C. Lea Prize, Jefferson Medical College, March, 1878, by Henry Morris, M. D.

† According to Dujardin-Beaumetz the toxic effects of the alcohols increase with the sum of their atomic weights, with the exception of the highest and lowest.

Toxicology and Antidotes.—The symptoms of acute and of chronic poisoning by alcohol are too well known to need description. The treatment in cases of poisoning from alcohol is the same as that which is to be pursued in cases of poisoning from opium, except the use of atropia and flagellation. Ammonia is a physiological antidote, and later the exhibition of strychnia does good. *Mania-a-potu* is found in acute poisoning from alcohol, and is due to the direct action of alcohol on a brain rather unaccustomed to its effects. It differs from *delirium tremens*, which is a delirium of a trembling type found in chronic alcoholism. The habitual use of alcoholic narcotics in excess gives rise to a well-known train of mental and physical disorders; viz., dyspepsia, visceral obstructions, cirrhosis of the liver, gout, organic disease of the heart, Bright's disease, delirium tremens, paralysis, and even confirmed insanity.

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* *The Practitioner*, Vol. III, p. 15.

MEDICINAL USES.—Alcohol, in the form of vinous and spirituous liquors, is employed to rouse and support the system in *asthenia*, *pyemia*, *septicemia*, *asphyxia*, *syncope*, *shock*, *typhoid* and *typhus fevers*, *asthenic* and *malignant diseases*, *exhausting hemorrhages* and *suppurations*, *gangrene*, to counteract the effects of the *bites of venomous reptiles*, in *delirium tremens*, and in *poisoning* from digitalis, tobacco, and other narcotics; also as a stomachic in *colic*, *flatulence*, *dyspepsia*, *nausea*, etc. In typhoid and typhus fevers, alcohol probably acts as a physiological antidote to the blood-poison, and should be given in the very first stages of these fevers, regulating the size and frequency of the dose by the sounds of the heart and the character of the pulse. Rarely more than f℥vj-viij are required daily. As a stimulant in *diphtheria* its administration is of the greatest service in counteracting the depressing effects of the poison, in *cerebro-spinal meningitis* to arouse from collapse, to sustain the vital powers in *capillary bronchitis*, and in the treatment of acute *lobar pneumonia*, to prevent heart-insufficiency it is our most efficient remedy, the indications for its administration being the same as in typhoid fever. Indeed the early administration of the preparations containing alcohol furnishes our best means of counteracting the depressing action of disease in general. The true stimulant or supporting effects of alcohol probably depend upon its appropriation by the system through oxidation or other agency. In disease, large quantities are administered which cannot be recovered in the excretions. But in health, when the powers of the economy are at the normal standard, it probably circulates in the blood unchanged, and accumulates in the viscera or is eliminated by the secretions. In *insomnia* due to cerebral anemia, a little alcohol at bedtime will often produce refreshing sleep. Alcohol, when prescribed to build up the system, should be given after food, in order to hinder it from diffusing too rapidly into the blood. For this purpose it is administered in conditions of *anorexia*, in *convalescence* from acute maladies, in *neurasthenia*, *phthisis* and *cerebral anemia*. Small doses induce aphrodisiac effects and are therefore serviceable in functional *impotence*. The hypodermic injection of a syringeful of brandy or whiskey, repeated if necessary, is an efficient restorative in *collapse* and in *asthenic* conditions generally, especially where dissolution appears to be imminent. As a *topical* application, alcohol is used to produce cold by its evaporation; as a styptic; to harden the cuticle over delicate parts, as in *bed-sores;* and as a stimulant with ammonia water it makes a useful wash in premature *alopecia*. Mixed with white of eggs, it forms a good coating to *bed-sores*.

Alcohol Dilutum (*Diluted Alcohol*), or *Proof-Spirit*, consists of equal parts of alcohol and distilled water, and has a sp. gr. 0.928. It is used exclusively for pharmaceutical purposes.

Vinum (*Wine*). The fermented juice of the grape consists of water and alcohol in varying proportions with *fixed* and *volatile acids*, *sugar*, *œnanthic acid* and *ether*, *tannic*, *malic* and other *acids*, *potassium bitartrate*, etc. Wine loses most of its cream of tartar by age. It is employed medicinally in *typhus* and *typhoid fevers*, *convalescence*, *exhausting chronic diseases*, *extensive suppurations*, *gangrene*, *asthenia*, etc. In *typh-fevers* it constitutes our chief therapeutic resource, and may be administered to the amount of one or two pints in the twenty-four hours, either pure or in the form of *wine-whey*. This is made by adding from a gill to half a pint of white wine to a pint of boiling milk, separating the curd from the whey, and flavoring with sugar and spices.

The official wines are VINUM ALBUM (*White Wine*), containing between 10 and 12 per cent. of absolute alcohol by weight; VINUM ALBUM FORTIUS (*Stronger White Wine*), containing between 20 and 25 per cent. of absolute alcohol; and VINUM RUBRUM (*Red Wine*), containing between 10 and 12 per cent. of absolute alcohol. Red wines are more astringent than white, as they contain more tannic acid. They are suited to conditions of *anemia*. *Port Wine* contains tannic acid, and is used in *chronic dysentery* and *diarrhœa*, for its astringency. *Madeira*, which is the strongest of the white wines, is an excellent stimulant, but may be objectionable from its acidity. *Champagne* is a pleasant stimulant where gastric irritability is present, particularly iced champagne in *yellow fever*. Madeira and port contain about 23 per cent. of alcohol; sherry, 19 per cent.; champagne, 13 per cent. As articles of diet, the stronger wines, when used in excess, often produce gout, and diseases of the kidneys and liver; and except in advanced age and in feeble constitutions, or where the tuberculous diathesis exists, cannot but be considered as objectionable.

Spiritus Vini Gallici (*Brandy*) is obtained by the distillation of wine. It contains about 50 per cent. of *alcohol*, with *water*, *volatile oil*, *tannic acid*, *coloring matter*, etc. It is the best stimulus where a rapid and decided impression is called for, as in *collapse* and *syncope*; and, from the tannic acid which it contains, is useful in bowel complaints, as *chronic diarrhœa* and *dysentery*. SPIRITUS FRUMENTI (*Whiskey*), obtained from fermented grain by distillation, is of about the same alcoholic strength as brandy, and may be substituted for it; it does not contain tannic acid. RUM (*Spiritus Sacchari*), the ardent spirit obtained from sugar, is more sudorific than brandy. GIN (*Spiritus Juniperi*) is corn-spirit flavored with oil of juniper; and owing to the oil of juniper which it holds in solution, it is an active diuretic as well as stimulant and stomachic. *Arrack*, the spirit of Eastern countries, is prepared from a fermented infusion of rice. SPIRITUS MYRCIÆ (*Spirit of Myrcia*), *bay-rum*, the spirit obtained by distilling rum with the leaves of myrcia acris, is a refreshing *local* application.

The MALT-LIQUORS are useful where permanent stimuli are called for, as in diseases tending to emaciation, *chronic abscesses*, as well as *asthenia*, *convalescence, and phthisis*. In wakefulness caused by *cerebral anemia*, a glass of ale or beer, at bedtime, is an efficient hypnotic. They are *contraindicated* in all chronic liver and renal affections and in disorders of the alimentary canal accompanied with acidity and flatulence, especially in those disorders depending on the fermentation of food. Although they contain a much smaller proportion of alcohol (2 to 6 or 8 per cent.) than the wines, yet their habitual ingestion will inevitably cause fatty degeneration of the liver and heart, already alluded to. Besides alcohol they contain extract of malt, and are, therefore, to some extent, nutritive. The best are porter and ale.

Extractum Malti (*Extract of Malt*) is official. It is made by macerating and then digesting coarsely-powdered MALT (the SEED of Hordeum distichum, or barley (*Nat. Ord.* Graminaceæ) caused to enter the incipient stage of germination by artificial means and dried) with water, straining and evaporating the fluid thus obtained to the consistence of a thick honey. It has a yellowish-brown color and the sweet taste of malt. It contains some *dextrine, sugar, bitter* and *aromatic substances*, and is used as a tonic in *asthenia* and *neurasthenia*. It possesses few advantages over good malt-liquors. It is used as a vehicle for cod-liver oil. It aids the digestion of starch by promoting its conversion into dextrine and glucose. It may be given in doses of f℥j-iv after meals.

AMMONIÆ PRÆPARATA—PREPARATIONS OF AMMONIA.

Ammonia (sometimes termed *volatile alkali*) is a gaseous compound of hydrogen and nitrogen (NH_3), which is found abundantly as the result of the decay of organic substances, and is usually obtained by the action of lime on sal ammoniac (or ammonium chloride). It has a pungent odor, and is very soluble in water; it is a powerful stimulant and local irritant, but is rarely used in medicine.

Incompatibles.—With the carbonates, the acids vegetable and mineral, solution of the acidulous salts, the earthy salts and lime-water.

Aids.—Internally by alcohol, ether, and capsicum; locally by cantharides and blistering agents.

Physiological Effects.—*Locally*, ammonia in solution acts as an irritant, causing vesication, and after prolonged contact, sloughing of the surface. If the gas be sniffed into the upper air-passages irritation, sneezing, and a flow of tears ensue. When inhaled for any time it produces inflammation of the laryngeal and bronchial mucous membranes, and may cause pneumonia *Internally*—Nervous system: when injected into the veins of animals it causes convulsions, due to stimulation of the motor-centres of the spinal cord and of its reflex functions. Circulation: after intravenous injections, a momentary fall in the arterial presure takes place, followed by a decided and sudden rise (not due to any action on the vaso-motor nerves, as it occurs after section of the cord), and a corresponding increase in the rapidity of the pulse from stimulation of the accelerators of the heart. Blood: it prevents the coagulation of the blood, assists in retaining the fibrogenous materials in solution, and impairs the function of the red corpuscles as oxygen-carriers. Respiration: when injected into the veins the respiratory act is greatly accelerated. Elimination: it is probably, to a great extent, oxidized in the system, and is eliminated as nitric acid, and perhaps as urea, by the kidneys. The effects just described are produced also by the following preparations of ammonia, which are employed as diffusible stimuli:—

Aqua Ammoniæ Fortior (*Stronger Ammonia-Water*). This is an aqueous solution of ammonia of the specific gravity 0.900. It is a colorless liquid, wholly volatilizable by heat, of a caustic, acrid taste and has a very pungent odor of ammonia. It is too strong for medicinal use internally in its unmixed state, as it contains 28 per cent., by weight, of gaseous ammonia. It is a powerful corrosive poison, for which the diluted acids, as vinegar or lemon-juice, are the antidotes. In the case of a man* who swallowed f℥j of it, death followed suddenly, his breathing being obstructed, and the lips, tongue, uvula and tonsils much swollen, reddened and glazed. It is used *externally* as a vesicant, and has the advantage over cantharides of a more speedy operation and non-affection of the urinary organs, but it is a very painful application.

Aqua Ammoniæ (*Ammonia-Water*) has a specific gravity of 0.959, containing 10 per cent., by weight, of ammonia, and is employed as a *stimulant*, *antacid* and *rubefacient*. As a stimulant, ammonia is admirably adapted for speedily arousing the action of the vascular and respiratory systems, as in *cerebral anemia*, *collapse*, and *shock*, especially when it is an object at the same time to excite the action of the heart. For this purpose it is employed in low forms of disease, particularly in the *typhoid state*, in *syncope*, in *asphyxia* from narcotic poisons, and to counteract the effects of the *bites of venomous reptiles*. In *dyspepsia* it is useful with a view to the relief of both acidity and flatulence. For internal use other preparations of ammonia are generally preferred, and this is used chiefly as a rubefacient. Dose, internally, gtt. x–xxx, largely diluted. As a *rubefacient* the official *liniment* (*q. v.*) may be used.

Spiritus Ammoniæ (*Spirit of Ammonia*) is a solution of ammonia in alcohol, containing 10 per cent. of the gas. It is given as a *stimulant*, *antacid* and *carminative*, in the dose of gtt. x–xxx diluted with water. But a pleasanter preparation, with similar properties, is—

Spiritus Ammoniæ Aromaticus (*Aromatic Spirit of Ammonia*). This is a solution of ammonium carbonate and water of ammonia, oil of lemon, oil of pimenta, and oil of lavender flowers, in water and alcohol. It is a very agreeable *antacid*, *stomachic* and *stimulant*, and may be given in the dose of gtt. xxx to fʒj, or more, diluted with water. It is useful in *alcoholismus* as a substitute for liquor when the craving for this comes on.

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* Guy's Hosp. Reports, XVII, 3d ser., p. 225.

Ammonii Carbonas (*Ammonium Carbonate*) ($NH_4HCO_3 \cdot NH_4NH_2CO_2$), being analogous in its effects to those of the preparations of ammonia, is considered here. It is prepared by subliming a mixture of ammonium chloride and chalk, and consists of a mixture * either of one or two molecules of acid ammonium carbonate and one molecule of ammonium carbamate. It occurs in whitish, transparent masses, wholly dissipated by heat, of a pungent, ammoniacal odor, an acrid, alkaline taste, and is soluble without residue in water. On exposure to air it becomes opaque, falls into powder, and deteriorates by the loss of ammonia.

EFFECTS AND USES.—Its indications are the same as those of solution of ammonia, to which it is preferred for internal exhibition as a diffusible stimulant. It is especially valuable in *pneumonia*, and by some therapeutists is relied on to the exclusion of other medication in this disease. By others it is here regarded serviceable only as a stimulant ranking after alcohol, and without influence to prevent heart-clot (Loomis). The truth seems to be that it is adapted only to cases which can be antagonized by its physiological action. It is a useful adjunct to other remedies in the treatment of *capillary bronchitis;* and in *chronic bronchitis* with profuse expectoration, diminished strength and impeded cardiac action, its exhibition, gr. v, every hour or so, is indicated. It has been recommended in threatened thrombosis, as that of the *puerperal state.* Dose, gr. v–x, in pill or preferably in solution with gum and sugar. The fluid extract of glycyrrhiza somewhat disguises its unpleasant taste. Mixed with some aromatic oil (as that of bergamot or lavender), it is used as a *smelling salt* in *syncope* and *hysteria.*

AROMATICS.

Aromatics owe their virtues to the presence of oils obtained from them by distillation, and termed VOLATILE OILS (*olea volatilia*), sometimes also *distilled* and *essential* oils. These oils possess, in a high degree, the odor and taste of the plants from which they are procured. *Locally*, they are powerful irritants, and, when taken into the stomach in overdoses, act as acrid poisons. They pass partially into vapor at ordinary temperatures, and are completely volatilized by heat; hence, decoctions and extracts are improper preparations of the aromatics. The distilled oils are inflammable, very slightly soluble in water, but soluble in alcohol and ether. Their ultimate constituents are, usually, carbon, hydrogen, and oxygen; and on exposure to the air they gradually absorb oxygen, become thicker, less odorous, and of a deeper color, and are finally converted into resins. The *effects and uses* of most of the members of this group are similar. In medicinal doses they are used as *carminatives*, and are combined with purgatives to *prevent griping*. Most of them are also useful as flavoring ingredients. To many of the volatile oils emmenagogue virtues have been ascribed; but these effects are only produced by poisonous doses. *Locally*, they are used as *rubefacients*, *antiseptics* and to allay *neuralgic pains*.

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* "U. S. Dispensatory," 1888, p. 172.

CAPSICUM.

Capsicum or Cayenne pepper is the FRUIT of Capsicum fastigiatum and other species of Capsicum (*Nat. Ord.* Solanaceæ), American tropical plants, naturalized in most warm climates, and cultivated in our gardens. C. fastigiatum is a small shrub, with a crooked, branching stem, producing in each fork two or three fruits from one-half to three-quarters of an inch long, of a subconical form and crimson or yellow color. The pods, when dried and ground, form capsicum, the best of which is the *African*, or bird's eye pepper, as they contain the most capsaicin. Powdered capsicum has a bright-red color, which fades upon exposure to light, an aromatic, peculiar smell, and a bitterish, acrid, burning taste. An acrid, crystalline principle termed *capsaicin*[*] ($C_9H_{14}O_2$), slightly soluble in water, but very much so in alcohol and ether, exists in capsicum, associated with *resin*, *fixed* and *volatile oil*.

CONTRAINDICATIONS.—Capsicum should not be given in acute inflammatory affections of the stomach, intestines or genito-urinary apparatus.

EFFECTS AND USES.—*Locally*, capsicum acts as an irritant, and vesication may be produced by prolonged contact with the skin. When applied to the mouth or nose it induces sneezing.

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[*] Flückiger, "Pharmacographia," 2d ed., p. 454, isolated also a volatile alkaloid having the smell of conium, from the seeds and pericarp of capsicum.

Internally.—Circulation: it increases the action of the heart. Secretion: it stimulates the glands with which it comes in contact, and increases the flow of the saliva and the gastric and intestinal juices. Elimination: it passes out of the system by the kidneys, increasing the flow of urine, and sometimes producing vesical tenesmus and aphrodisiac effects. In large doses it acts as a gastro-intestinal irritant. Capsicum is principally *employed* as a *condiment* and *stomachic*, and is very useful in torpid conditions of the digestive organs, or as an adjunct to other remedies to arouse the susceptibility of the stomach. Its constitutional effect is not in proportion to its local effect, and it is, therefore, of no great efficiency as a diffusible stimulant. It is a good stomachic in the *dyspepsia* of drunkards; it also may be given as a substitute for liquor in *alcoholismus*. It is employed as a gargle, and also as a cataplasm to cause counterirritation. *Dose*, of the powder, gr. v–x, in pill; of the *tincture* (5 parts to diluted alcohol 95 parts), ♏x–f℥j; of the *fluid extract*, ♏v–x. The *oleo-resin* is a powerful rubefacient, and may be given internally in the dose of gr. ss-j. A *plaster* is also official.

PIPER—PEPPER.

Black pepper is the UNRIPE FRUIT of Piper nigrum (*Nat. Ord.* Piperaceæ), a vine of the East Indies. The berries are gathered before they are quite ripe, cleansed by washing and sifting, and dried in the sun, when they are known as shot-pepper. They are wrinkled and black, in consequence of the drying of the pulp over the grayish-white seed, and in this state are known as *black* pepper. If permitted to ripen, and soaked in water till the outer coat is removed, they constitute *white* pepper. Pepper has an aromatic, peculiar odor and a hot, spicy, pungent taste. Its properties are taken up by alcohol and ether, and partially by water. It contains a *volatile oil*, an *acrid resin*, to which the pungent taste of the drug is due, and a crystalline neutral alkaloid of feeble power, called *piperine* ($C_{17}H_{19}NO_3$), isomeric with morphia, which is used as an antiperiodic remedy.

Effects and Uses.—In warm-blooded animals piperine reduces the number of respirations, increases the frequency of the cardiac beats (apparently from paralysis of the vagus-center), dilates the pupils widely, and arrests the heart in systole. The effects of pepper are similar to those of capsicum. It is a warm *carminative stimulant*, chiefly employed as a condiment, but it is also useful as a stomachic in *dyspepsia*. Dr. C. S. Taylor reports success with piperine in the treatment of *intermittent fever* where quinine had failed, or the idiosyncrasy of the patient would not permit its employment. Dose, gr. v–xx. Of the *oleo-resin* the dose is gr. ss–ij. PIPERINA (*piperine*) may be prescribed in doses of gr. ij–x.

CINNAMOMUM—CINNAMON.

There are two varieties of cinnamon—Ceylon cinnamon, which is the inner BARK of the shoots of Cinnamomum zeylanicum, a tree of Ceylon and Java; and China cinnamon, or cassia, the BARK of the shoots of one or more undetermined species of Cinnamomum (*Nat. Ord.* Lauraceæ), trees of China. The most esteemed is the *Ceylon* cinnamon. It is found in the shops in long, cylindrical pieces, which are very thin and smooth, and of a yellow-brown color and a splintery fracture. It has a fragrant odor and a warm, sweetish, aromatic, slightly astringent taste. Its constituents are *volatile oil*, *tannic acid*, *mucilage*, *sugar*, *mannit*, etc. The greater part, however, of the cinnamon brought to this country is the *cassia* cinnamon. It has the general appearance, smell and taste of true cinnamon, but the pieces are not doubly quilled. Its properties are identical with those of the Ceylon variety.

EFFECTS AND USES.—Cinnamon is an *aromatic stimulant*, with a slight astringency. It is used chiefly as a carminative, and as an addition to other medicines. Dose, gr. x-xxx; of the *tincture* (10 parts alcohol and water enough to make 100 parts of tincture), the dose is f℥j–iij. *Oleum Cinnamomi* (*oil of cinnamon*) is of a light-yellow color, which deepens by exposure to the air, with the development of an acid, termed *cinnamic;* dose, gtt. i–ij. *Aqua cinnamomi* (*cinnamon-water*) is used as a vehicle for other medicines. *Spiritus Cinnamomi* (*spirit of cinnamon*) contains 10 parts of the oil dissolved in 90 parts of alcohol; dose, gtt. x–xx. Cinnamon enters into a large number of preparations.

MYRISTICA—NUTMEG.

MACIS—MACE.

The products are portions of the FRUIT of Myristica fragrans (*Nat. Ord.* Myristicaceæ), a tree of the Moluccas, cultivated also in Java and Sumatra and other parts of the East Indies, and introduced into the isles of France and Bourbon and several of the West India islands. It bears a pyriform fruit about the size of a small peach, which has a fleshy pericarp, opened by two longitudinal valves. Within this is the ARILLUS, a scarlet reticulated membrane, which, when dry, becomes yellow-brown and brittle, and is termed *mace*. The KERNELS OF THE SEED are the *nutmegs*. They are oval, of the size of an olive, of a grayish-brown color, marked with furrows; and to preserve them from the attacks of an insect, they are steeped in a mixture of lime and water. Mace has a pleasant, aromatic smell and a warm, bitterish, pungent taste. Nutmegs have a delightfully fragrant odor and a warm, aromatic, grateful taste. Nutmeg contains a *volatile oil* (consisting of myristicene, $C_{10}H_{16}$, and a little myristicoll, ($C_{10}H_{14}O$), *fixed oil* (25 per cent.), *starch*, *proteids*, etc. From mace, also, a *volatile oil*, etc., is obtained.

EFFECTS AND USES.—Nutmeg is one of the most agreeable of the *aromatic stimulants*, and is much employed for its carminative virtues, also as a flavoring ingredient, and to obviate the griping effects of cathartics. It possesses narcotic properties. This was exemplified in the case of a child who fell into profound slumber after having eaten five large nutmegs.* Mace is chiefly employed as a condiment. Dose of either, gr. xx–xxx. *Oleum myristicæ* (*oil of nutmeg*) is of a pale straw-color; dose, gtt. ij–iij. *Spiritus myristicæ* is made by dissolving 3 parts of the oil in 97 parts of alcohol; dose, f℥j–ij. The fixed oil of nutmeg is known in the shops as oil of mace, *adeps myristicæ* (not official); it is used in liniments.

CARYOPHYLLUS—CLOVES.

Cloves are the UNEXPANDED FLOWERS of Eugenia caryophyllata (*Nat. Ord.* Myrtaceæ), an evergreen tree of the Moluccas. They are from five to ten lines long and from one line to one line and a half thick, the corolla forming a ball or sphere at the top, and the calyx a tapering, somewhat quadrangular base, resembling a nail, whence the common name, from the French, *clou*. When good, they are of a dark-brown color, with a yellowish-red tint; they have a strong, fragrant odor, a hot, acrid taste, and when pressed with the nail, should give out oil. They contain a highly pungent *volatile oil*, *tannic acid*, *resin*, etc., and two crystalline principles, termed *caryophillin* and *eugenin;* the oil consists of a hydrocarbon ($C_{10}H_{16}$) and a colorless oil termed eugenol or eugenic ($C_{10}H_{12}O_2$).

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* N. Y. Med. Jour., Sept. 28, 1889.

Effects and Uses.—Cloves are among the most stimulating of the aromatics, but are used chiefly as a flavoring ingredient and a condiment. Dose, gr. v–x. The *oil*, *oleum caryophylli*, is pale or yellowish, becoming darker by age; dose, gtt. iij–vj.

PIMENTA.

Pimenta, called also *Allspice*, is the UNRIPE BERRIES of Eugenia Pimenta (*Nat. Ord.* Myrtaceæ), a handsome evergreen tree of the West Indies and South America. It comes exclusively from Jamaica, and consists of round, brown, roughish berries, rather larger than black peppercorns, with an external hard, brittle shell, enclosing two dark-brown seeds. They have an aromatic, agreeable smell and a strong clove-like taste. They are principally used as a condiment. The oil, *oleum pimentæ*, has a brownish-red color, and consists of a hydrocarbon and eugenic acid; dose, gtt. iij–vj.

Oleum Cajuputi (*Oil of Cajeput*). The *volatile oil* distilled from the leaves of Melaleuca cajuputi (*Nat. Ord.* Myrtaceæ), a tree of the Moluccas, is a powerful diffusible aromatic stimulant, much employed in Eastern countries, and of late coming into use in the United States. It is a transparent oil, of a fine green color, a lively, penetrating odor, analogous to that of camphor and cardamom, and a warm, pungent taste. It is an admirable remedy for the relief of *nausea* and intestinal *colic*, and is added as a carminative to purgative pills to prevent griping; dose, gtt. j–v.

ZINGIBER—GINGER.

Ginger is the RHIZOME of Zingiber officinale (*Nat. Ord.* Zingiberaceæ), a perennial herbaceous plant, growing to the height of two or three feet. Its native country is Asia, where it has been cultivated from time immemorial, and was early introduced into the tropical regions of America. Ginger-root occurs in flattish, jointed, branched or lobed pieces, which rarely exceed four inches in length. In the young state, the roots are preserved in sugar, and form a very pleasant sweetmeat. When old, they are taken up, scalded in hot water, and dried, when they are known as *black ginger*. Sometimes they are scraped previously to being dried, and are then called *white* or *Jamaica ginger*. Both varieties have a powerful odor and a warm, pungent, aromatic taste. They impart their virtues to water and alcohol, and contain a pale-yellow *volatile oil gingerol* (to which the hot taste is due), *resin*, *starch*, etc.

Effects and Uses.—Ginger is a *pungent, aromatic stimulant,* much employed as a stomachic in *flatulency, dyspepsia,* and *colic* of the stomach and bowels. It is used also as a condiment, and to correct the unpleasant taste and nauseating qualities of other medicines. A paste made of the powder and warm water is used as a counterirritant. Dose, gr. x–xx, in pill. The official preparations are: *tincture*—dose fʒss–j; *fluid extract*—dose, gtt. xx–xxx; *syrup*—used as a vehicle for other medicines; *oleo-resin*—dose, gtt. j–ij; and *troches* (made by mixing the tincture with tragacanth, sugar, and a little syrup of ginger).

CARDAMOMUM—CARDAMOM.

Cardamom is the FRUIT of Elettaria Cardamomum (*Nat. Ord.* Zingiberaceæ), a perennial plant, from six to nine feet high, found in the mountainous parts of Malabar. Three varieties of Malabar cardamoms are known in commerce: *shorts, short-longs,* and *long-longs,* all furnished by the same plant. They are ovate-oblong, from three to ten lines long, coriaceous, ribbed, and of a grayish or brownish-yellow color, and contain a number of blackish or reddish-brown seeds, which have a pleasant, aromatic odor and a warm, aromatic, agreeable taste. They yield a colorless *volatile oil,* a *fixed oil, starch,* etc.

Effects and Uses.—Cardamom is a very agreeable aromatic, devoid of acridity, and is employed as a stomachic and carminative, and as an adjuvant and corrective of other medicines; dose, gr. v–x. The *tincture* (15 parts to diluted alcohol 85 parts) is the preparation chiefly used; dose, fʒj–ij. The *compound tincture* contains cardamom, and also caraway, cinnamon, cochineal, diluted alcohol, and glycerin. Free acids separate insoluble carminic acid in the latter preparation.

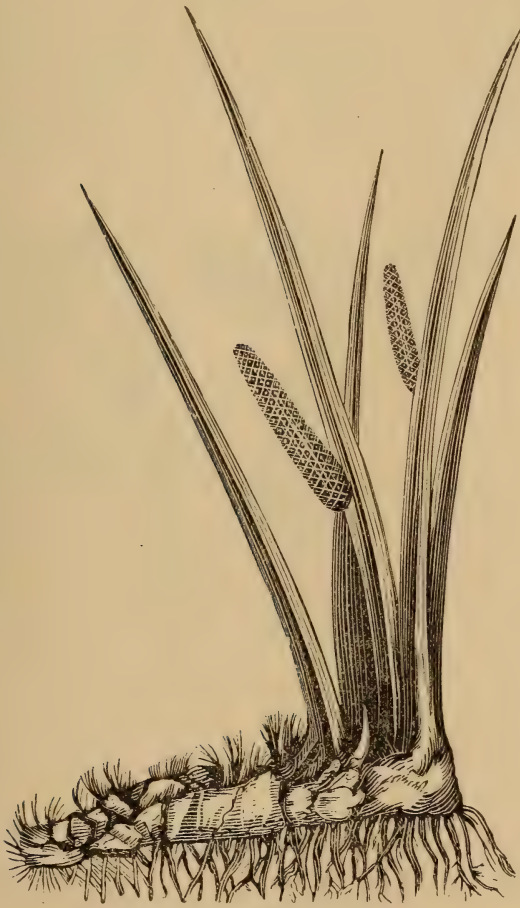
Pulvis Aromaticus (*Aromatic Powder*) consists of cinnamon and ginger, each 35 parts, and cardamom and nutmeg, each 15 parts. It is used as a carminative in doses of gr. x to xxx.

Extractum Aromaticum Fluidum (*Aromatic Fluid Extract*) is a fluid extract of aromatic powder. It is chiefly used as a flavoring ingredient in mixtures, but may be used where aromatic powder is indicated in doses of fʒss–j or more.

CALAMUS

The RHIZOME of Acorus calamus or Sweet Flag (*Nat. Ord.* Araceæ), an indigenous marshy plant, with long, sword-shaped, radical leaves (giving out a delicious fragrance when rubbed), is a valuable aromatic stimulant, with some tonic properties. According to Cadéac and Meunier,* the essential oil has a special affinity for the nervous system, being a powerful convulsive and tetanizing agent and dangerous when mixed with liquors. The rhizome is found in the shops in somewhat flattened pieces, deprived of their epidermis, wrinkled, and of a yellowish color, and has a strong,

FIG. 18.



ACORUS CALAMUS. RHIZOME.

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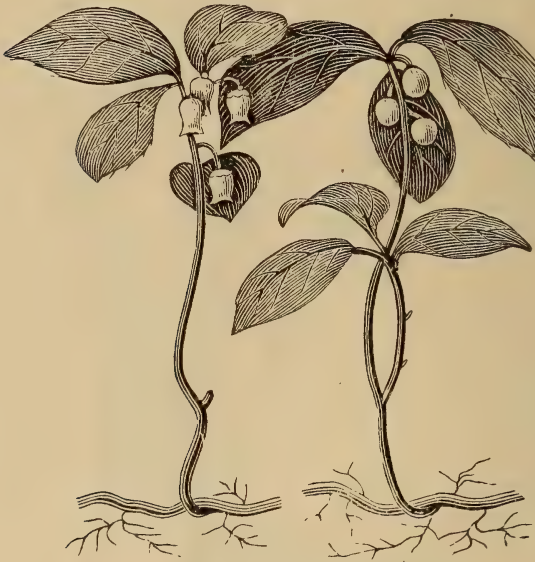
* Compt. Rend. Soc. de Biol. Sér. 9; Paris, 1890, p. 509.

fragrant odor and a warm, bitterish, aromatic taste. It contains *volatile oil*, *acorin* (probably a glucoside), *resin*, *starch*, etc. Dose, gr. xx to ʒj. A *fluid extract* is official; or it may be given in infusion.

GAULTHERIA.

Gaultheria procumbens, Partridge-berry, Deer-berry, or Tea-berry (*Nat. Ord.* Ericaceæ), is a small indigenous evergreen plant, with reddish stems, a few inches in height, bright-green leaves, and white, ovate, five-toothed flowers, followed by scarlet berries. The LEAVES are the official portion, and contain a very stimulating *volatile oil* (*oleum gaultheriæ*), which, when first distilled, is colorless, but gradually becomes reddish, and is distinguished as being the heaviest of volatile oils. It consists of gaultherilene ($C_{10}H_{16}$) $\frac{1}{10}$ part, and methyl salicylate ($CH_3C_7H_5O_3$) $\frac{9}{10}$ parts. The leaves also contain *arbutin*, *ericolin*, *urson*, *tannin*, *sugar*, etc. The official preparations are the *oil* and the *spirit* (containing 3 parts of the oil in 100 of the preparation). An infusion of the leaves is in very general popular use as a carminative and stomachic.

FIG. 19.



GAULTHERIA PROCUMBENS. LEAVES.

Toxicology.—Dr. Pinkham[*] reports four cases of poisoning by oil of gaultheria, in which fʒss was the fatal dose in each. In all severe symptoms of irritation of the gastro-intestinal tract and disturbance of the cerebral functions were noted. It seems to be a narcotico-irritant poison.

Effects and Uses.—The oil of gaultheria possesses antipyretic powers about equal to those of sodium salicylate, and it has been used for this purpose with considerable success in acute rheumatism. Dr. Kinnicut[†] reports twelve cases treated by it with the following results: Complete absence of pain in about three days; duration of fever, 3½ days; average stay in hospital, 24⅓ days. Gottheil[‡] finds that it reduces the local swelling and relieves the pain (four cases); while A. Flint, Sr.,[§] states that the average length of confinement to hospital was, in eleven cases, less than five days—a very favorable showing. All of these observers gave it in frequently repeated doses (gtt. x), Flint in flaxseed tea.

AURANTII AMARI CORTEX—BITTER ORANGE-PEEL.
AURANTII DULCIS CORTEX—SWEET ORANGE-PEEL.

The rind of the fruit of Citrus vulgaris, or Bitter Orange, and Citrus aurantium, or Sweet Orange (*Nat. Ord.* Auranticeæ), is much employed as a flavoring addition to other medicines. They contain *volatile oils*, *hesperidin* (a bitter crystalline glucoside), etc. The flowers (*aurantii flores*) yield a delightful volatile *oil* termed *oil of neroli* (official), consisting of a hydrocarbon and some neroli-camphor. The following are the official preparations: *orange-flower water* (*aqua aurantii florum*), an agreeable vehicle, possessing slight antispasmodic virtues; *syrup of orange-flowers* and *syrup of orange* are used as excipients and vehicles for medicines of unpleasant flavor; *oil of orange-peel; fluid extract of bitter orange-peel; spirit of orange; elixir of orange-peel.* The *tincture of bitter orange-peel* and *tincture of sweet orange-peel* may be given in doses of fʒj–ij.

The following aromatics, of the natural order Labiatæ, are pleasant carminatives and stomachics:—

Lavandula (*Lavender*). The flowers of Lavandula vera, a small European shrub, cultivated in our gardens, about two feet high, with fragrant blue flowers, which are gathered in June, and dried in the shade. They have an agreeable fragrant odor and a pungent, bitter taste. They contain *volatile oil*, *resin*, a little *tannin*, etc. The *oil* (*oleum lavandulæ florum*), which is of a pale-yellow color, or the *oil of lavender* (*oleum lavandulæ*)—a volatile oil distilled from the whole herb), may be used in the dose of from gtt. j–v. But the preferred preparations are the *spirit* (*spiritus lavandulæ*) and the *compound tincture* (*tinctura lavandulæ composita*), which contains also oil of rosemary, cinnamon, cloves, nutmeg, and red saunders; dose, fʒj.

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[*] *Boston Med. and Surg. Journ.*, Dec. 8th, 1887.

[†] *N. Y. Med. Record*, 1882, p. 505.

[‡] *Ibidem*, 1883, p. 256.

[§] *Ibidem*, 1883, p. 725.

Mentha Piperita (*Peppermint*) and MENTHA VIRIDIS (*Spearmint*) are European plants, naturalized in the United States. The LEAVES and TOPS are employed; they have an aromatic odor and a pungent, somewhat bitter taste, followed by a sensation of coolness. Mentha viridis contains a *volatile oil*, *gum*, *resin*, etc.; Mentha piperita a *volatile oil* (consisting of $C_{10}H_{18}O$ and a crystallizable substance termed *menthol*,[*] $C_{10}H_{20}O$), a little *tannin*, *resin*, etc.

Braddon[†] has recently called attention to the antiseptic properties of peppermint oil, and he experimentally found it (up to 1 to 3000) to be superior, in the prevention of decomposition, to such agents as corrosive sublimate and carbolic acid. For minor surgical operations he used successfully gtt. j to olive oil f℥j soaked in lint. In this form it is packed into *sinuses*, and suppurating *buboes*, and applied to *ulcers*, and *rupia*, being retained by a strip of rubber plaster. The results obtained by him with the inhalation of the pure oil, as a germicide in *phthisis*, are scarcely conclusive, though in some cases it seemed to be beneficial. The *oils* may be given in doses of gtt. x–xx–xl: useful in flatulent *dyspepsia*, given after meals. *Two waters* are also official (*aqua menthæ piperitæ* and

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[*] MENTHOL (*Mint-Camphor*) is obtained by the fractional distillation of the oil of peppermint, and to it the oil owes its peculiar odor. It occurs in colorless prisms which are said to correspond to the Chinese *solid* oil of peppermint, It has, of late years, been extensively used as an anodyne application in the treatment of *neuralgic pains*, especially those occurring in the supra orbital and temporal regions, as headache, but is equally efficient in neuralgias affecting other regions, It is also recommended for the relief of *rheumatic pains*, It is found in the shops in cones or pencils under the name of Menthylene, etc,, but the best preparation for external use is a solution in alcohol (ʒj of the pure crystals to f℥ss) painted over the part with a brush.

A. Rosenberg[*] uses menthol 20 parts to ether 100, or 50 of alcohol, as a substitute for cocaine to produce local anæsthesia of the nasal cavities and pharynx, He finds that it induces anemia of the mucous membrane and diminution of sensibility.

[†] *The Lancet*, March, 1888, pp. 512, 567.

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[*] *Central. für gesamt. therap.*, Oct., 1886, p. 441.

aqua menthæ viridis, both much used as vehicles). The oil of peppermint is the stronger of the two, and is strongly recommended as an anodyne application in allaying the neuralgic pains of *herpes zoster*.* *Troches of peppermint* are made by rubbing up oil of peppermint with sugar and mucilage of tragacanth.

Vinum Aromaticum. (*Aromatic wine*) is made by percolation, and contains 1 part each of lavender, origanum, peppermint, rosemary, sage, and wormwood, with sufficient stronger white wine to make the filtered liquid weigh 100 parts.

Rosmarinus (*Rosemary.*) Rosmarinus officinalis, or Rosemary, a European evergreen shrub, cultivated in our gardens, contains a very stimulant *volatile oil* (oleum rosmarinus) which is chiefly used as an ingredient of rubefacient liniments. It is also used in making *spiritus odoratus* (cologne-water). The LEAVES are used. They enter into *vinum aromaticum.*

Hedeoma (*Pennyroyal*). Hedeoma pulegioides, or Pennyroyal, is an indigenous annual plant, about a foot high, with oblong lanceolate, serrated leaves, and small, pale-blue flowers arranged in axillary whorls. The LEAVES and TOPS are used, which contain a light-yellow essential *oil*, similar in properties to the mint-oil, but somewhat more powerful. A body, termed *hedeomol* ($C_{10}H_{18}O$), has been extracted from the oil by Franz,† of which it constitutes 33 per cent.

Origanum. The HERB of Origanum vulgare, or common Marjoram. The essential *oil* is an ingredient in stimulating liniments, but is not official. Origanum enters into *vinum aromaticum.* Hanbury states that the oil of origanum of the shops is only oil of thyme.

Marrubium (*Horehound*). Marrubium vulgare possesses mild, stimulant, tonic and expectorant properties, and, in large doses, proves laxative. It is used chiefly in *cough* syrups and candies. The LEAVES and TOPS are employed.

Salvia (*Sage*). The LEAVES of Salvia officinalis, a European plant, cultivated in our gardens, are used as a condiment, and may be given in infusion as a gargle in *pharyngitis;* they are slightly tonic and astringent, as well as aromatic. It is an ingredient of *vinum aromaticum.*

Oleum Thymi (*Oil of Thyme*). The *volatile oil distilled* from the

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* *The Practitioner*, London, August, 1882, Meredith.

† *Am. Jour. of Pharm.*, April, 1888, p. 161.

Thymus vulgaris is often substituted for oil of origanum, and is used as an external application. The oil of thyme consists of *cymene* ($C_{10}H_{14}$), *thymene* ($C_{16}H_{16}$), and *thymol* ($C_{10}H_{14}O$), occurring in highly aromatic colorless crystals, and has been found a valuable antiseptic and antifermentative agent (see *Antiseptics*).

The following aromatic SEEDS are derived from plants of the natural order UMBELLIFERÆ :—

Fœniculum (*Fennel*). The FRUIT of Fœniculum vulgare, a European plant, cultivated in our gardens. It may be used in infusion; the dose of the *oil* is gtt. v–xv. *Fennel-water* is official.

Carum (*Caraway*). The FRUIT of Carum Carvi, a European plant, cultivated in this country. Dose of the *oil*, gtt. j–x.

Anisum (*Anise*). The FRUIT of Pimpinella anisum, cultivated throughout the south of Europe. Dose of the *oil*, gtt. v–xv. *Anise-water* (*aqua anisi*) and *spirit of anise* are also official.

Coriandrum (*Coriander*). The FRUIT of the Coriandrum sativum, an annual plant of the south of Europe. The *oil* is official.

Illicium (*Star Anise*). The FRUIT of the Illicium anisatum (*Nat. Ord.* Magnoliaceæ), an evergreen tree of China and Japan is official. It contains a *volatile oil* (which is chemically identical with the oil of anise, but has a slightly different odor and taste), *fat*, *resin*, etc. (Maisch). The oil possesses analogous properties to those of the oil of anise, and is much used as a substitute for it.

VANILLA.

This is the FRUIT of Vanilla planifolia (*Nat. Ord.* Orchidaceæ), a climbing plant of Cuba and Mexico, cultivated also in various parts of tropical America, in the Mauritius, Reunion and Java.

The pods, when gathered, are yellow, but by exposure to the sun they assume a dark copper color. They are cylindrical, somewhat flattened, wrinkled, six or eight inches long, three or four lines thick, and contain a soft black pulp, in which numerous small black seeds are embedded. Vanilla has a strong characteristic, highly pleasant odor, and a warm, aromatic, sweetish taste; the interior pulpy portion is most aromatic. The odorous principle of vanilla is a crystalline substance termed *vanillin* ($C_8H_8O_3$), which can be made synthetically from coniferin; it is found only in the interior and not in the exterior fleshy portion. It is a *mild diffusible stimulant*, chiefly used, however, as a perfume and flavoring ingredient. The *tincture* is official.

ORDER VII.—SEDATIVES.

Sedatives are medicines which diminish the frequency of the action of the circulation. They are employed therapeutically to reduce excitement of the vascular system.

With sedatives may be included also the medicinal agents termed *refrigerants*, comprising nearly all the neutral alkaline salts, as well as those in which the acid predominates, and the vegetable acids. These substances have little power of diminishing the ordinary or healthy temperature; but they lower febrile heat, allay thirst, restore the secretions, and in this way are very useful adjuvants in the treatment of febrile complaints.

ACONITUM-ACONITE.

Aconitum Napellus, Aconite, Wolfsbane, or Monkshood (*Nat. Ord.* Ranunculaceæ), is a native of the mountainous parts of Europe and Asia. The TUBEROUS ROOT is the official portion. It is brought from Europe, India, and Japan, and other species of Aconitum than A. Napellus furnish some of the aconite of commerce. Its taste is bitterish and acrid, and when chewed occasions a peculiar feeling of tingling and numbness in the tongue and interior of the mouth. These properties are impaired by long keeping, when the plant loses its medicinal efficacy.

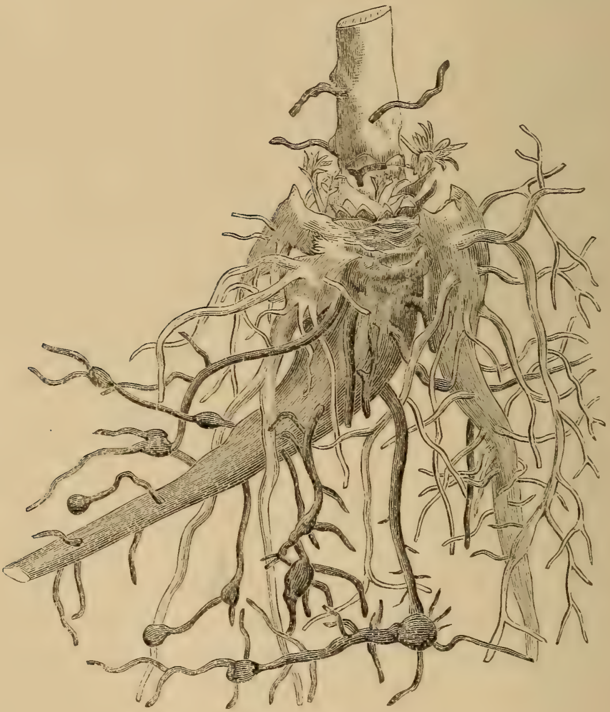
CHEMICAL CONSTITUENTS and TESTS. The active principle of aconite is an alkaloid named *aconitine* ($C_{33}H_{43}NO_{12}$). Four other alkaloids, *pseudaconitine* ($C_{36}H_{49}NO_{11}$), *aconine* ($C_{26}H_{39}NO_{11}$), *pseudaconine* ($C_{27}H_{41}NO_{8}$), and *picraconitine* ($C_{31}H_{45}NO_{10}$), have been found in it, but the chemistry of aconite is not well settled.

ACONITINE exists in combination with a peculiar acid termed *aconitic*, and is prepared from an aqueous solution of an alcoholic extract of aconite-root, by the addition of sulphuric acid (which converts the natural salt of aconitine into a sulphate). It is a white amorphous powder, with a tinge of yellow (though it has been obtained in crystals), without smell, of a bitter, acrid taste, and produces in the mouth a sense of numbness. It is partially soluble in water, and is readily dissolved by alcohol and chloroform, less readily by ether. There is no characteristic chemical test for aconitine, but a strong aqueous solution of hydrobromic acid saturated with bromine throws down the aconite salts, or aconite itself, as a yellow precipitate, even if it be present in minute quantity ($\frac{1}{25000}$, Wormley) in medico-legal cases, the *physiological test*, by producing numbness and tingling of the lips or skin, *must be resorted to.* As aconitine is easily decomposed, the commercial article is more or less impure.

Wright and Luff* isolated from the roots of Japanese aconite only one alkaloid, *japaconitine*, which can be split into *japaconine*, both of which closely resemble aconitine and aconine in physical properties.

Aconitine is an exceedingly virulent poison, more powerful when pure than hydrocyanic acid. It is scarcely adapted to internal use, as even gr. $\frac{1}{50}$ has produced alarming results. Morson's aconitine, prepared from the cultivated A. Napellus, is terribly potent, even gr. $\frac{1}{1000}$ producing numbness of the tongue.

FIG. 20.



ACONITE-ROOT.

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* *Journal of Chemical Society*, vol. 1, p. 387, 1879.

AIDS.—Veratrum viride, veratria, cold, quinine, pulsatilla, phytolacca and cardiac depressants generally.

CONTRAINDICATIONS.—Debility of the circulatory apparatus; cardiac valvular lesions with regurgitation.

PHYSIOLOGICAL EFFECTS.—Aconite applied *locally* causes a sensation of numbness and tingling, induced by its benumbing effect on the sensory nerves. The following account of the action of aconite is based on the investigations of Mackenzie,* Laborde et Duquesnel,† and of Plugge.‡ Nervous system: taken in small doses aconite exerts no influence upon the cerebrum, but its taste is pungent and benumbing, and it produces a feeling of numbness in the head, face, and extremities. Aconite has no action upon the motor-nerves, the loss of reflex action caused by it being due to paralysis of the sensory end-organs, extending to the nerve-trunks, and finally to the spinal sensory centres. The spinal motor-centres are only involved when total palsy has set in. Circulation: aconite exerts a marked influence on the circulatory apparatus, small doses reducing the heart's action and lowering the arterial pressure; lethal doses stop the heart in diastole. Aconite applied to the heart slows it so that it may be concluded the drug is a cardiac poison acting directly on its motor ganglia. It is also believed to stimulate the cardiac inhibitory apparatus. According to the researches of Ringer and Murrell, aconite paralyzes all nitrogenous tissues, and it is in this way that the heart's beats are retarded. In other words, it acts directly against the heart's contained motor-apparatus. Respiration: these movements tend to become slow, and the temperature is lowered. Secretions: aconite increases the secretion of the skin and kidneys, and is probably eliminated by the latter.

TOXICOLOGY.—In lethal doses, its effects are those of an acro-narcotic poison, the symptoms being a burning or benumbing sensation in the mouth, throat, and tongue, followed by gastric irritation, spasmodic purging, short, shallow, and superficial respirations, contraction or expansion of the pupils, though dilatation is the rule; numbness or paralysis of the limbs ensues, the skin is cold and clammy, convulsions set in, the pulse fails, and death results from syncope. Aconitized animals remain conscious until death takes place. In several instances a drachm of the tincture has destroyed human life.

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* *The Practitioner*, xx, 1878, pp. 100, 185.

† *Revue de Méd.*, iii, 1883, p. 804.

‡ *Ibidem*, p. 1045.

ANTIDOTES.—In case of poisoning, the stomach is to be thoroughly evacuated, and cardiac stimulants, externally and internally, are to be freely administered. The object of physiological antidotes being to keep the heart acting, hypodermics of atropine sulphate and aqua ammoniæ will be found powerful excito-motors for this purpose. *Digitalis* is advised by Fothergill.

MEDICINAL USES.—Aconite is a powerful remedy in the treatment of *neuralgiæ*, especially when the 5th pair of cranial nerves are affected. It is often combined with quinine in these cases, and should be given in doses sufficient to produce its characteristic physiological effects to a slight degree. A local application of the tincture or of a liniment or ointment is often resorted to with advantage, while the drug is administered internally.

From its influence on the circulation it is applicable to those cases of *inflammation* in which general bloodletting was formerly resorted to with advantage, as it slows the pulse-rate and lowers the arterial tension, at the same time reducing the temperature and causing diaphoresis and diuresis.

Thus it is applicable in all cases of sthenic inflammatory fever, occurring in robust young adults with a full, tense, bounding, strong and frequent pulse, and does most good before the effusion of inflammatory products has taken place. It is not so efficacious, however, in typhoid conditions of the system, where the heart is weak or where there exists any acute inflammation of the gastro-intestinal mucous membrane.

Its timely administration may be of much service to control cardiac action in *apoplexy* and so prevent further hemorrhage, to calm or hold in check the circulatory apparatus in *vascular excitement*, and *congestion*, and to be beneficial in these conditions it should be given in doses large enough to make its influence felt.

In *surgical fever* it is better given in small doses, frequently repeated until its effects on the pulse are manifested, when the interval between the doses should be increased, and it may be administered either alone or combined with other remedies, as in the following fever mixture: ℞ Morphinæ sulphatis, gr. j–ij; tincturæ aconiti, ♏xxiv; potassii acetatis, ℥ss; spiritûs ætheris nitrosi, fʒvj; liquoris ammonii acetatis, f℥iss; syrupûs limonis, ad f℥iij. M. S.—fʒj in water every 2, 3 or 4 hours as indicated.

Aconite may be prescribed in this way and for these effects, not only in surgical fevers but also in idiopathic inflammatory conditions, provided the indications for its employment are present. In *acute tonsillitis* it will not infrequently cut short the attack if administered in time; in *acute pharyngitis*, *acute laryngitis* or *acute bronchitis*, it is of undoubted value when given early, in small doses and frequently repeated. An incipient *coryza* may be aborted by the timely use of aconite, given as above, until the pulse is reduced in volume and frequency, although for this purpose veratrum viride is generally preferred. In the early stages of *acute otitis media*, if the circulation be excited, much relief may be obtained by a combination of aconite with morphine and potassic bromide, and the external application of heat. In certain diseases of the respiratory organs, aconite is of great value, not only from its action on the circulation, but because it slows the respiratory act. Thus in *acute pleurisy* before the stage of effusion has been reached, if the patient be strong and robust and the pulse full and bounding, tincture of aconite gtt. j should be given every 15 or 20 minutes, until the pulse is influenced, while morphine (gr. $\frac{1}{6}$–$\frac{1}{4}$) should be administered hypodermically, and wet or dry-cups freely applied to the affected side, followed by a large poultice.

In *acute catarrhal pneumonia* aconite is also beneficial, and even in the first stage of *lobar pneumonia* it may be cautiously administered combined with some of the ammonium salts, but it must be discontinued as soon as effusion has taken place. It possesses no advantage over veratrum viride in these cases, and the latter is probably the safer remedy.

In *phthisis*, when the disease tends to spread, it may be given cautiously, to reduce the pulse-rate and moderate the fever.

In *acute peritonitis* aconite is of the greatest value and should be combined with large doses of opium. In those forms of peritonitis occurring during the puerperal period and due to septic infection, aconite is contraindicated, a supporting and antiseptic plan of treatment giving better results (see puerperal septicemia, under quinine).

In *acute cerebral* or *acute spinal meningitis* aconite is also of great value. It is indicated in many of the essential *fevers*, as in *febricula*, in which disease a fever mixture containing aconite, and the administration of small doses of calomel, frequently cut short the attack.

To moderate the excessively rapid pulse of *scarlatina*, as well as for its antipyretic, diaphoretic and diuretic action, aconite is of the greatest utility. In *measles*, also, and in sthenic cases of medical *erysipelas* it has been advantageously prescribed.

In the early stages of *cerebro-spinal fever* before exudation has taken place, it may be given with large doses of opium and potassic bromide, while the local abstraction of blood by leeches, followed by cold to the head and neck is employed.

To moderate the fever and pulse in the hot stages of *intermittent* and *remittent fever*, aconite is also used, and in the latter affection it is often efficacious in relieving the intense headache which so frequently accompanies this stage.

From its effects on the heart itself aconite is of the greatest value in cases of *cardiac hypertrophy* when not compensatory to valvular lesion. In cases of simple hypertrophy, *palpitation* and *over-action*, it is our most available remedy combined with rest in the recumbent posture, but should any valvular disease exist, great caution must be exercised in prescribing it. In *cerebral hyperemia* of active type, by diminishing the force and frequency of the cardiac contractions, it proves most beneficial.

It has also been resorted to in the treatment of *internal aneurism* as a cardiac sedative.

Aconite is recommended in *amenorrhœa* from taking cold, but is not always successful.

In congestive *dysmenorrhœa* it has also been employed, but possesses no advantage over other remedies.

It has also been recommended to check the *vomiting of pregnancy*.

As a *topical* anodyne, aconite, as might be inferred from its local *benumbing* action, is a most useful remedy in *neuralgiæ* and *chronic rheumatism*, either painted over the part in the form of a tincture or applied as a liniment or ointment, and sometimes when thus used it has a marked beneficial effect. Admixture with chloroform aids the absorption of its alkaloid, and thus enhances its effect; but when thus used it should be employed with care and not applied to too large a surface for fear of too rapid absorption.*

Aconitine has been used *internally* and *locally* in the treatment of *tic douloureux* and other forms of trigeminal neuralgia. Duquesnel's aconitine is preferred for internal administration in doses of $\frac{1}{300}$–$\frac{1}{120}$. It is a very active poison, and *if employed at all*, should be used with the greatest care.

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* "A Text-Book of Pharmacology, Therapeutics and Materia Medica." By T. Lauder Brunton, M. D., etc. London: 1885, p. 753.

Locally, it is used in *neuralgiæ*, as *sciatic*, or *facial*, in alcoholic solution (gr. j–ij to alcohol fʒj), or as an ointment (gr. ij to lard ℥j, rubbed up with alcohol gtt. vj). When applied to the temple or brow great care should be exercised to prevent any from coming in contact with the conjunctiva, as absorption from the membrane is very rapid and may occasion poisoning.

Administration.—The dose of the powdered *root* is gr. ¼ to j; of the *abstract*, gr. ½ to j; of the *fluid extract*, ♏ ⅙–iij; of the *extract* (alcoholic), gr. ⅛–¼; of the *tincture*, which is by far the best preparation (400 parts of the powder are contained in 1000 parts of the tincture), ♏ ¼–v. These doses are to be repeated twice or thrice daily, and cautiously increased till the effects of the medicine are apparent, or in acute febrile affections the smaller doses may be given and repeated every 15 to 30 minutes until the pulse is influenced or diaphoresis occurs. The tincture may be used externally.

VERATRUM VIRIDE.

Veratrum viride, known as American Hellebore, Swamp Hellebore, Poke-root, Indian Poke, etc., (*Nat. Ord.* Melanthaceæ), is a swampy plant, indigenous to the eastern portion of the United States, growing to the height of from three to six feet. The RHIZOME and ROOTLETS are the official portions. The rhizome is an inch or two in length, thick and fleshy, with numerous yellow rootlets, and is found usually in the shops in slices or fragments, externally of a blackish color and internally of a dingy-white color. It is inodorous, but has a bitter, acrid taste, which leaves a permanent impression on the mouth and fauces. For use, attached portions of the dried stem should be rejected, as they are inert.

Chemical Constituents.—C. L. Mitchell's* analysis of the rhizome shows it to contain *veratroidine* and *jervine* (the latter found also in V. album), *rubijervine*, *pseudojervine*, with resin and oily

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* *Proceedings* Am. Pharm. Associat., 1874, p. 397.

According to Wright and Luff* the alkaloids of veratrum viride are essentially *jervine*, *pseudojervine*, *cevadine*, with a trace of veratrine and veratalbine, cevadilline being absent; of veratrum album, *pseudojervine*, *jervine*, *veratalbine*, *rubijervine* and veratrine (a trace).

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* *Journal of Chemical Society*, Vol. 1, 1879, p. 405.

matter. Some authorities state that it contains also *veratrine* (Wormley), but this is still an open question. Veratroidine is a white, uncrystallizable powder, of a bitter taste, leaving a tingling sensation in the fauces, soluble in alcohol, ether and chloroform. Jervine is a white, tasteless powder, which crystallizes from an alcoholic solution, insoluble in water and ether, and freely soluble in alcohol and chloroform.

AIDS.—Upon the heart, aconite; its emetic action is favored by ipecacuanha.

CONTRAINDICATIONS.—The preparations of veratrum viride should only be given to strong, robust patients, and rarely made use of in any asthenic malady, or in cardiac valvular disease.

PHYSIOLOGICAL EFFECTS.—*Veratroidine* is an *emetic*, and sometimes a *cathartic*, and a *depressant* to the circulation. Nervous system: in animals poisoned by veratroidine, twitching and finally convulsions are produced; the reflex spinal centres are at first depressed, afterward paralyzed. Circulation: applied directly to the heart, it paralyzes the cardiac muscle. When given hypodermically* to animals, it at first lessens the rapidity of the pulse and lowers the arterial pressure (due to stimulation of the inhibitory nerves); soon, however, the heart's beat becomes greatly increased in force, but not in frequency, and the blood-pressure falls to normal; then suddenly the pulse becomes very rapid, and the cardiac force is lessened (due to peripheral paralysis of the inhibitory nerves), and the tension rises much above the normal (caused by increasing asphyxia). Respiration: in animals poisoned by veratroidine, death is caused by asphyxia, due to paralysis of the respiratory muscles. Muscular system: there is great muscular weakness in poisoned animals. Gastro-intestinal tract: veratroidine is an irritant, causing violent vomiting and purging in poisoned animals.

Jervine produces general weakness (without, however, vomiting or purging), lowering of arterial pressure and slowness of the pulse, profuse salivation, and finally convulsions. *Locally*, jervine is a feeble irritant. Nervous system: the effects of jervine are similar to those of veratroidine, but, in addition, the vaso-motor nerves are paralyzed. Circulation: † when applied directly to the heart of the frog, it paralyzes it. When a warm-blooded animal is poisoned with jervine, the frequency of the pulse is diminished, and the arterial pressure falls greatly, due to the direct action of the drug on the cardiac muscle, as well as to paralysis of

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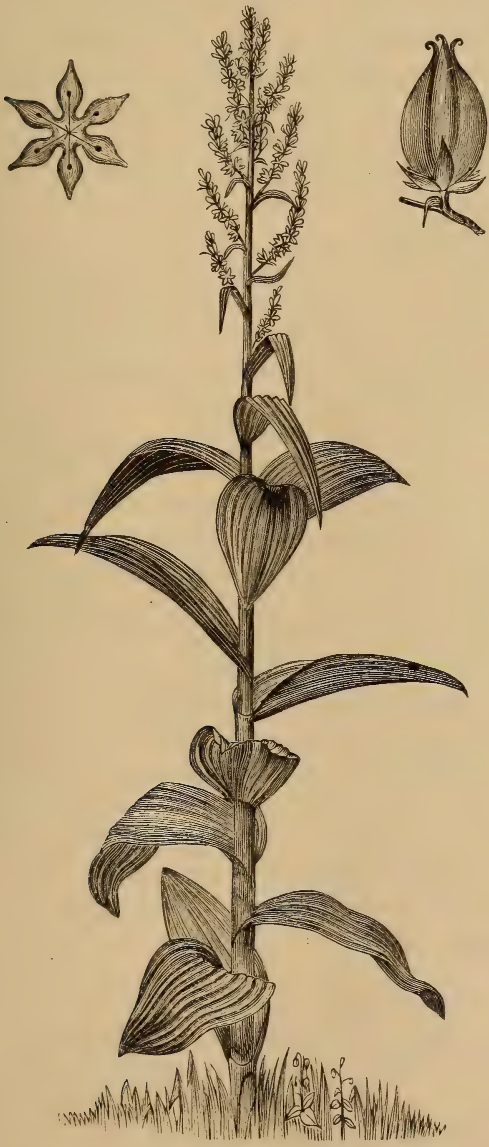
* *Phila. Med. Times*, Vol. IV. H. C. Wood.

† *Ibid.*

FIG. 20.



VERATRUM VIRIDE.

the vaso-motor centres. Respiration: death takes place from asphyxia.

The alkaloids exist, in both V. viride and album, in but small proportions, and can scarcely be profitably extracted.

The effects of *veratrum viride* are similar to those of its two alkaloids described above. It is an active *local* irritant. Taken *internally*, it somewhat promotes the flow of urine, and in doses of about five grains proves emetic. In continued doses it produces a *marked sedative action on the circulation*, irrespective of the nausea induced, which, indeed, may be prevented by careful administration, and the temperature of the body is much lowered. It has not generally proved laxative.

TOXICOLOGY.—A few fatal cases are recorded from its use—though stimulants almost invariably counteract any excessive sedation. Recovery has taken place after f℥j of the tincture had been swallowed, while fʒj of the tincture has destroyed life,* and in another case † about ♏xxx proved fatal.

MEDICINAL USES.—Veratrum viride is used principally as a *cardiac* and vaso-motor *depressant*. In *pneumonia*, in which the danger is chiefly from failure of cardiac power, the use of veratrum requires caution and is serviceable only in the early stage, before exudation has taken place. It is also useful in cardiac affections, as *over-action of the heart*, or *hypertrophy* unaccompanied by valvular disease, and to moderate *vascular excitement*. In active *hemorrhage* and in acute congestions generally it is also of value as a sedative. It has been recommended in *puerperal eclampsia*,‡ on account of its depressing influence on the reflex centres of the cord (Fordyce Barker, Boyd, N. L. Guice, etc.); it should be given in doses sufficiently large to reduce the pulse to 60 or 80 beats per minute and this effect should be maintained. A few drops of the tincture repeated every hour or two, according to the condition of the pulse, will abort an ordinary "cold in the head," if given early enough). Dose, of the powder, gr. j–ij to begin with; of the *tincture*, gtt. v–x; of the *fluid extract*, gtt. iv–v.

Veratrina (*Veratrine*) ($C_{32}H_{52}N_2O_8$) is an alkaloid or mixture of alkaloids obtained from the seeds of Asagræa officinalis (*Nat. Ord.* Melanthaceæ), an herbaceous plant of Mexico, which contains *no*

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* *Med. Times*, Aug., 1884, p. 863.

† *Med. and Surg. Reporter*, May, 1873, p. 379.

‡ *Canacian Practitioner*, March, 1885, p. 366.

jervia.[*] It is made by evaporating a strong tincture of the seeds to the consistence of an extract, from which the alkaloid is dissolved by diluted sulphuric acid, and afterward precipitated by magnesia. When pure it is white, but it is usually a grayish or brownish-white powder, without odor, but very irritant to the nostrils, and of a bitter, acrid taste, producing a sense of tingling or numbness in the tongue; scarcely soluble in cold water, but readily soluble in alcohol, and of an alkaline reaction. A delicate *test* for veratrine is *Trapp's*—a permanent lilac-red color, resembling a solution of potassium permanganate, afforded by boiling it in hydrochloric acid.

PHYSIOLOGICAL EFFECTS.—*Locally*, veratrine acts as an irritant,[†] producing heat, pain, and numbness in the part to which it is applied. Nervous system: its action on the brain is not marked, and the reflex excitability of the spinal cord is diminished in animals after the administration of a large dose (Ott). Veratrine acts as a direct poison upon nerves (Ott, Wood, H. C., etc.), but whether it affects the nerve-trunk or its end-organs is still *sub judice.* Circulation and blood: in animals, small doses stimulate the excito-motor cardiac ganglia and increase the frequency of the cardiac beats; large doses stimulate the pneumogastric nerve, and as the excito-motor ganglia become exhausted, the cardiac beat is slowed. It also poisons the cardiac muscle. It probably paralyzes the central vaso-motor[‡] apparatus eventually. The blood-pressure is, at first, elevated, then lowered, and the blood is rendered less coagulable. Respiration and temperature: small doses increase, while larger doses diminish, the frequency of the respiratory movements, and the temperature is lowered. It destroys life by paralysis[§] of respiration. Excretion: the excretions from the skin and kidneys are increased. Gastro-intestinal tract: in large doses it is an irritant poison, causing severe vomiting and purging.[||] Muscular system:[¶] muscular irritability is at first exalted (producing convulsions), but is afterward entirely lost. Heat[**] increases and cold lessens the effects of veratrine on muscle. Its toxic action is comparable to that of its congeners. Elimination: by the kidneys.

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[*] *Proceed.* Am. Pharm. Associat., 1874, p. 397. C. L. Mitchell.

[†] *Bull. Gén. de Thérap.*, CV, 430. Sur l'action physiologique de la vératrine.

[‡] *Arch. für Exper. Pathol. u. Pharmakol.*, 1887, p. 36. Untersuchungen über die Wirk. der Veratrumalkaloide, von H. Lissauer.

[§] *Ibid.*

[||] *Bull. Gén. de Thérap.*, CV, 430. Sur l'action physiologique de la vératrine.

[¶] *Journal de l'Anatomie et de la Physiologie*, 1868, p. 206.

[**] *The Journal of Physiology*, Vol. IV, p. 1.

Stimulants and ethereal inhalation would be the proper treatment in cases of poisoning.

MEDICINAL USES.—*Veratrine* is rarely prescribed *internally;* the dose is gr. $\frac{1}{12}$ to $\frac{1}{6}$ repeated; it is chiefly used *externally*, in the form of *ointment* (4 parts, to alcohol 6 parts, and benzoinated lard 96 parts); or dissolved in alcohol, as an application to *rheumatic* and *neuralgic affections. Oleatum veratrinæ* (veratrine oleate) consists of veratrine 2 parts, to 98 parts of oleic acid: useful in *spinal irritation*, rubbed over the vertebræ.

PULSATILLA—PASQUE-FLOWER.

The HERB of Anemone pulsatilla, Anemone pratensis and Anemone patens (*Nat. Ord.* Ranunculaceæ), is found in both hemispheres. It should be collected soon after flowering and carefully preserved, but should not be kept more than a year. It contains an acrid volatile *oily substance*, easily converted into anemonin, $C_{15}H_{12}O_6$, and *anemonic acid*, $C_{15}H_{14}O_7$. (Maisch).

INCOMPATIBLES.—The caustic alkalies, tannic acid, and metallic salts.

AIDS.—Aconite enhances its action upon the heart, respiration and temperature.

PHYSIOLOGICAL EFFECTS.—*Locally*, fresh pulsatilla is an irritant, and after prolonged contact with the skin may cause inflammation, or even gangrene. When the powder is inhaled, it produces itching of the eyes, colic, vomiting, diarrhœa, etc. (Phillips). Nervous system: motor and sensory paralyses are produced in animals by large doses, but in what way has not yet been ascertained. After poisonous doses, dilatation of the pupil, sopor, coma, and convulsions occur. Circulation: pulsatilla is a cardiac depressant, and lowers the arterial pressure. Respiration and temperature: it slows the respiration (Clarus), and reduces the temperature. Gastro-intestinal tract: it is an irritant poison, in large doses producing vomiting and purging. Elimination: probably takes place through the kidneys.

MEDICINAL USES.—Pulsatilla, owing to its irritant action on the digestive tract, is not well borne, and, moreover, possesses no superiority over more efficient sedatives like aconite.

The powdered herb may be given in doses of gr. ij–v, or an extract or tincture may be made.

ARNICA.

Arnicæ Flores, Arnica Flowers; Arnicæ Radix, Arnica Root.

Arnica montana, Leopard's Bane (*Nat. Ord.* Compositæ), is a perennial herbaceous plant, found in northern Germany and other northern countries of Europe, and also in the northwestern portions of America. The FLOWER-HEADS and the RHIZOME and ROOTLETS are the official portions. Both contain *volatile oil*, *arnicin*, *resins*, etc.; the root contains, in addition, *inulin* and *tannin*.

EFFECTS AND USES.—*Locally*, arnica is a stimulant and often an irritant to the skin. The internal effects of this drug are not well understood. Large doses cause headache and dilatation of the pupils; poisonous doses paralyze the nervous system, and death ensues from collapse. Moderate doses lower (in dogs) the pulse by stimulating the pneumogastrics peripherally and centrally, raise slightly the arterial pressure, and depress the respiration and temperature. (H. A. Hare.*) Small doses are said to excite the action of the skin and kidneys. In large amounts it is an irritant to the gastro-intestinal tract, producing nausea, vomiting and purging of a choleraic character, and also great muscular weakness.

In this country it is principally used *externally*, in the form of fomentation or lotion, for the relief of *bruises*, *wounds*, *sprains* and local *paralysis*. The *fluid extract of the root* (*alcoholic*) is given in doses of gr. v–x. This is chiefly used, however, in making a *plaster* (*emplastrum arnicæ*). The *fluid extract of the root* is given in doses of ♏x–xx. The *tincture of the root* and the *tincture of the flowers* may be given in doses of ♏v–xxx. They are often used externally combined with soap-liniment. In applying arnica externally, the irritating qualities of the drug should be borne in mind.

PHYTOLACCA.

Phytolaccæ Bacca, Phytolacca Berry; Phytolaccæ Radix, Phytolacca Root.

Phytolacca is the FRUIT and ROOT of the Phytolacca decandra (*Nat. Ord.* Phytolaccaceæ), commonly known as Poke-Berries and Poke-Root. It is a perennial herb, indigenous to North America, growing to the height of four to eight feet, and found in waste places. The young stems, collected in the spring and boiled, are sometimes eaten at table. The root contains *resin*, *starch*, *tannin*, etc.; the berries contain *sugar, gum,* coloring matter, etc. An indifferent crystalline principle termed *phytolaccin* has been isolated, by Claassen.* Partee,† in a recent analysis of the root, could detect no alkaloid.

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* *Boston Med. and Surg. Journ.*, Jan. 12th, 1888.

EFFECTS AND USES.—Phytolacca paralyzes the motor-centres of the cord and medulla. In overdoses it causes dimness of vision, coma and sometimes convulsions (Stillé and Maisch), and death is produced by paralysis of the respiratory centre. Phytolacca depresses the cardiac action and respiration, and produces nausea and vomiting, which does not take place until about an hour after the drug is administered, and which is accompanied by great depression. Purging also takes place, and Rutherford found it to be a powerful hepatic stimulant, increasing the secretion of bile. It is eliminated by the kidneys.

Phytolacca has been used with success as an alterative in the treatment of *rheumatism cf syphilitic origin* (Stillé and Maisch). It is useful in *phlegmons*‡ of the breast, to allay the inflammation and prevent suppuration, and possibly may exert a like influence on other inflamed glands, as *adenitis.*

It is recommended as a local application to leg *ulcers* (Tidd §) and *eczema,* and also in *scabies* and *tinea capitis.*‖ As it produces great depression it should not be used as an emetic. Dose of the powder, gr. j–xxx; or a tincture (℥jv–Oj), or fluid extract may be used, dose ♏v–fʒj. For *local* use, an ointment may be prepared (ʒ–℥j). These preparations are not official.

STAPHISAGRIA.

Staphisagria, Stavesacre, or Licebane, is the SEED of the Delphinium Staphisagria, (*Nat. Ord.* Ranunculaceæ), a beautiful biennial plant, with terminal racemes of blue flowers, native of southern Europe. It contains three alkaloids, *delphinine* ($C_{24}H_{35}NO_{20}$), *delphinoidine, delphisine,* and *staphisain* ($C_{16}H_{23}NO_2$); also fixed oil, etc.

PHYSIOLOGICAL EFFECTS.—When *applied* to the skin *delphinine* acts as a rubefacient and irritant. When administered *internally* to animals in lethal amounts it produces convulsions, muscular incoordination, and finally clonic spasm; the reflex centres of the cord are palsied (Cayrade,* and cutaneous anæsthesia is produced (Falck and Rörig †), and finally the respiratory centre is paralyzed, causing death from asphyxia. The effects on the circulation are most marked. It slows the cardiac action and paralyzes the heart by a direct action on its muscle and nervous supply (Flack and Rörig,‡ L. Van Praag). It causes dyspnœa, slows the respiratory movements and paralyzes the voluntary muscles. It provokes salivation and induces vomiting (an early symptom), due to irritation of the end-organs of the pneumogastric nerves. It acts upon the digestive system no matter how introduced. It is eliminated chiefly by the biliary and salivary secretions and kidneys, producing constipation and difficult urination during excretion. It destroys life by asphyxia. The treatment of poisoning by staphisagria should be by artificial respiration, strychnia and atropia.

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* *The Pharmacist and Chemist,* 1879, p. 466.

† *Am. Journ. of Pharmacy,* March, 1888, p. 123.

‡ *Am. Jour. Med. Sci.,* 1873, p. 275.

§ *The Clinic,* Vol. V, p. 273.

‖ J. Bigelow, quoted in Piffard's "Mat. Med. and Therap. of the Skin."

Medicinal Uses.—It is chiefly used as a *local* parasiticide in *pediculi* and *scabies*, although an ointment is applied in *phthiriasis*. Dose of the powder, gr. j–iij; or a tincture (1 part to alcohol 5 parts—dose ♏x–xv), or fluid extract may be used. An ointment (digest ʒij of bruised seed in lard ℥j and strain while hot) is the best form for external use. None of these preparations are official.

ANTIMONII PRÆPARATA--PREPARATIONS OF ANTIMONY.

Antimonii Oxidum (*Antimonious Oxide*) (Sb_2O_3) is a heavy grayish-white, insoluble powder, having the general therapeutic properties of the antimonials, and though not quite certain in its effects—as its solubility depends on the amount of hydrochloric acid which may exist in the stomach—it is believed to produce the sedative operation of tartar emetic, with less nausea and derangement of the stomach. Dose, gr. ij–iij, repeated.

Antimonii et Potassii Tartras (*Antimonium and Potassium Tartrate*). This salt, familiarly known as *tartar emetic* and *tartarized antimony*, is prepared by boiling water and cream of tartar with antimonious oxide. It occurs in colorless, transparent, rhombic, octahedral crystals, which become white and opaque from efflorescence on exposure to the air. When pure its powder is perfectly white; but it is to be preferred in the crystalline state, as in this form it is less liable to adulteration. In *testing* for antimony the metal itself should be reduced, as by *Marsh's test* (see Arsenious Acid). The powder of tartar emetic is sometimes adulterated with cream of tartar, which may be detected by adding a few drops of a solution of sodium carbonate to a boiling solution of the antimonium salt, and if the precipitate formed be not re-dissolved, no potassium bitartrate is present.

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* *Journ. de l'Anat. et de Physiol.* Mai et Juin, 1869. 317.

† *Archiv. für. phys., Heilkun.*, 525–548, 1852, and *Rörig's Dissert. de Effectu Delphini*, Marburg, 1852.

‡ *Virch. Arch.*, Bd. VI., 385–448, und 435–457. See also Researches on Staphisagria in Bull. *Gén. de Thérap.*, 1891, by Gautier, p. 185.

Tartar emetic ($2KSbC_4H_4O_7.H_2O$) is inodorous; has a nauseous, metallic taste; is soluble in 15 parts of cold and 3 parts of boiling water; insoluble in pure alcohol.

INCOMPATIBLES OF TARTAR EMETIC.—It is decomposed by the alkalies and the alkaline carbonates; the vegetable astringents containing tannic acid form an insoluble tannate with it.

AIDS.—Aconite, veratrum viride, etc., enhance its sedative powers; ipecacuanha promotes its emetic effect; paregoric, sweet spirit of nitre and ipecacuanha (small doses), its diaphoretic action.

PHYSIOLOGICAL EFFECTS.—Tartar emetic is a powerful *local* irritant. Applied to the skin, it occasions an eruption of pustules, resembling those of variola or ecthyma. When taken into the stomach, in full doses, it causes vomiting, purging, griping pains, etc. The *constitutional* effects of tartar emetic, when taken *internally* in small doses, are an increase in the secretions and exhalations generally, especially from the skin; the quantity of carbonic acid exhaled by the lungs is increased; the amount of urine excreted is lessened, but the urea is much augmented (Ott); after large doses albuminuria is often seen; in somewhat larger doses, these effects are accompanied with nausea and vomiting, relaxation of the tissues (particularly the muscular fibres), a feeling of great feebleness and exhaustion, and at first a stimulant, later a powerful sedative, action on the circulation and respiration, the cardiac action becoming slow, weak and finally irregular, and the arterial tension lowered. It acts on the heart by depressing the excito-motor nerves and paralyzing the cardiac muscle. After poisonous doses the red blood-corpuscles are altered in form, and together with the albumen, are diminished in amount, in the blood of animals; the fibrin is increased (Ott). The temperature of the body is lowered. In small, repeated doses, continued for some time, it produces fatty degeneration of the liver. It is eliminated slowly by the bile, milk, perspiration and urine, also by the bronchial mucus and the intestinal secretions.

Toxicology.—In excessive quantity, it acts as an irritant poison, and has produced death with great prostration, syncope, and diminution of reflex irritability. The minimum fatal dose for an adult is gr. ij; for a child, gr. $\frac{3}{4}$ (Taylor). On the other hand, very large quantities have been taken without fatal results.

Antidotes.—Fortunately the ingestion of toxic amounts of tartar emetic is quickly followed by vomiting. But if the poison has not been entirely rejected, or if emesis has not occurred at all, tannic acid, the chemical antidote, should be administered (strong infusion of tea, cinchona or oak-bark) which forms an insoluble tannate, and consequently the absorption and irritative action of the poison is impeded. After this the stomach-pump must be used. Should there be evidence of much gastric irritation the exhibition of demulcents will be in order.

Medicinal Uses.—Tartar emetic is employed *internally* as an *emetic*, *sedative*, *sudorific* and *expectorant*, and *locally* as a counterirritant. It is to be used with great caution on account of the prostration which it produces, and should never be given to young children, nor when gastro-enteric inflammation is present. It should only be used in sthenic cases in robust adults. As an *emetic*, it creates more nausea and depression than any other substance; and hence, while other emetics are to be preferred to it, when our object is merely to evacuate the contents of the stomach with as little constitutional disturbance as possible, it is of value when vomiting is to be resorted to as a means of making an impression on the system in the hope of checking the progress of disease. As a *sedative antiphlogistic*, in large doses it is a most powerful remedy in the treatment of acute *inflammation*, with fever, from its combined action *in reducing the force and frequency of the circulation*, moderating the heat of the skin, and promoting diaphoresis. When given in this way, at intervals, tartar emetic ceases to produce emesis, owing to the establishment of *tolerance* of the medicine. It is inferior to other sedatives, as aconite, etc. In the early stages of *acute laryngitis* and *bronchitis*, it is a remedy of great value. From gr. $\frac{1}{16}$–$\frac{1}{4}$ may be given every two hours in gradually increasing doses, until some amelioration of the symptoms takes place, when the doses are to be again decreased; a favorite combination with many physicians is: ℞ Antimonii et potassii tartratis, morphinæ sulphatis, āā gr. j; aquæ, f℥ij. M. One teaspoonful contains gr. $\frac{1}{16}$ each of tartar emetic and morphine. As a *diaphoretic*, it is very useful in small doses (as from $\frac{1}{16}$-$\frac{1}{4}$, repeated), in continued *fevers*, inflammation from wounds, injuries, etc.; and as an *expectorant*, when there is fever, a full pulse, and but little expectoration, as in *acute bronchitis*, in the same doses; it is also employed in various pulmonary affections with advantage. As a *local irritant*, it is rarely used, and is in many cases injurious.

ADMINISTRATION.—The dose of tartar emetic, as an *emetic*, is gr. j–ij, and it is frequently combined with ipecac. As a *sedative antiphlogistic*, gr. ¼–½ to gr. j–ij. As a *diaphoretic and expectorant*, gr. $\frac{1}{16}$–$\frac{1}{4}$, may be given in solution, and in each case repeated every two or three hours. It is advantageously combined with small doses of morphine, when decided diaphoresis is aimed at.

Vinum Antimonii (*Antimonial Wine*) is a solution of tartar emetic (4 parts) in boiling distilled water (60 parts) and stronger white wine (to make 1000 parts). It is employed as an *expectorant* and *sudorific*, in *bronchitis*, etc., in the dose of from gtt. x–xxx, frequently repeated; and as an *emetic* for children, in the dose of gtt. xxx to fℨj, repeated every quarter of an hour. Other emetics are to be preferred.

Antimonii Sulphidum (*Antimonious Sulphide*), the native sulphide, purified by fusion, and *Antimonii Sulphidum Purificatum* (*Purified Antimonious Sulphide*), are used in making the other preparations.

Antimonium Sulphuratum (*Sulphurated Antimony*) is a reddish-brown, odorless, almost tasteless, insoluble powder, and is chemically a mixture of antimonious sulphide (Sb_2S_3) and oxide (Sb_2O_3). Its effects are analogous to those of tartar emetic. Dose, gr. j–iij; as an emetic, gr. v–xx.

Pilulæ Antimonii Compositæ (*Compound Pills of Antimony*), sometimes called *Plummer's Pills*. They are used as an alterative in rheumatic and cutaneous affections. One pill contains of calomel and sulphurated antimony each gr. ss.

Pulvis antimonialis. An *antimonial powder* is prepared in imitation of the celebrated *James's powder*, by mixing antimonious oxide (33 parts) with precipitated calcium phosphate (67 parts). It is a white, gritty, tasteless, odorless powder. Dose, gr. iij–viij.

POTASSII NITRAS—POTASSIUM NITRATE.

This salt, commonly called *nitre* and *saltpetre* (KNO_3), occurs in both the inorganic and organic kingdoms of nature. It is obtained, for medicinal use, principally by the purification of the native nitre of India; and it is found also in *saltpetre caves* in various parts of the United States, associated with calcium nitrate, from which it is separated by lixiviation. It is artificially produced in several parts of Europe, in nitre beds or saltpetre plantations, by bringing together decayed organic animal and vegetable matters. And it is manufactured sometimes by the double decomposition of sodium nitrate and potassium chloride. Nitre is *refined* by re-solution and crystallization of the *crude* nitre. As purified for medicinal use, it is found in the shops in large, transparent, colorless crystals, of the form of six-sided striated prisms, with dihedral summits, which are unalterable in the air. They have no odor, a sharp, cooling taste, are wholly soluble in water, and insoluble in pure alcohol. They are without water of crystallization, but frequently have a portion of the mother liquid mechanically lodged in the spaces of the crystals, which may be driven off by heat, and the salt fused and cast into moulds, when it is termed *sal prunelle*.

PHYSIOLOGICAL EFFECTS OF THE POTASSIUM PREPARATIONS.—As the effects of the potassium salts are largely due to their base, it will be more convenient to consider them together, pointing out any differences when the various preparations are considered. *Locally*, some of this group, as potassa fusa, abstract water from the tissues, dissolve albumen and saponify fats, and hence are caustics. The nitrate is a violent irritant when applied to mucous membranes or raw surfaces. Nervous system: in large doses, they may produce coma, and they act on the spinal centres, by lowering reflex excitability and causing paralysis of the lower extremities when given in large amounts. Circulation: all the potassium salts are cardiac poisons, their activity being due to the potassium, and varying with the amount of the base they contain. In moderate doses they slow the heart and increase the arterial pressure, while in large doses they both diminish the frequency of the cardiac pulsations and lower the blood-pressure. Animals poisoned by them die from cardiac paralysis (the heart being arrested in diastole), caused by direct action on the cardiac muscle and also by paralysis of the cardiac ganglia. Blood: after large doses, or when taken for some time, the blood is found to be less coagulable (the fibrin being diminished), the white corpuscles relatively increased, and the venous blood lighter in color (Phillips). After large doses of the nitrate or chlorate, the blood becomes dark and refuses to take up oxygen, and the hemoglobin is decomposed. The compounds with the vegetable acids increase the alkalinity of the blood. Temperature is reduced by large doses, especially when the nitrate or chlorate has been given. Secretion: the alkaline potassium compounds, like alkalies in general, when applied to the orifices of glands with acid secretions, increase, but when applied to glands with alkaline secretions, diminish their secreting power (Ringer). This does not apply to the nitrate. They increase the water of the urine and the urea, and lessen the amount of uric acid. If the bicarbonate is given during fasting, the acidity of the urine will be increased, but the urine will be alkaline if it is administered during digestion. The alkalinity of the urine is most marked after the ingestion of the salts with the vegetable acids (as the tartrate, citrate, etc.). The nitrate and chlorate do not affect the reaction of the urine.

Gastro-intestinal tract: when the alkalies are given on an empty stomach, the secretion of the acid gastric juice is increased; if given when gastric digestion is in progress, they neutralize the acidity of the secretion. In large amounts, potassa or the chlorate, nitrate, carbonate or chloride excites violent inflammation, causing vomiting, purging, etc. Nutrition: the alkalies in small doses improve digestion, aid in saponifying fats, and promote oxidation of tissue, but when administered for too long a time, especially if given in large doses, they cause emaciation and pervert nutrition. Elimination: the potassium salts are eliminated chiefly by the urine, but to some extent also by the other secretions. The salts with the vegetable acids, during their passage through the system, are converted into carbonates and are eliminated under this form. Potassium nitrate and chlorate are discharged unchanged in the urine and as sulphates in the feces.

Toxicology.—In *excessive doses*, nitre may act as a fatal poison, producing irritation of the alimentary canal and derangement of the nervous system; the symptoms are burning pain in the throat and stomach, bloody stools, a tendency to syncope, collapse, and death, sometimes preceded by dilated pupils, insensibility and convulsions. There is no antidote for it, and cases of poisoning are to be treated by demulcents, opiates, stimulants, etc., after evacuation of the contents of the stomach.

MEDICINAL USES.—Nitre is not as much used as it was formerly. It may be given as a *refrigerant* and *sedative* in *fevers*, *inflammations*, *hemorrhages*, etc. In fevers it is sometimes prescribed with calomel and tartar emetic, under the name of *nitrous powders* (nitre, gr. x; tartar emetic, gr. ⅛; calomel, gr. ¼ to ½). In large doses it was given formerly in *acute rheumatism*, and this practice has been revived with success in France. It is sometimes combined with Dover's powder (of each gr. iij–v or viij) in the treatment of acute muscular rheumatism. Dose, gr. x–xxx. From ʒiv–vj are given in twenty-four hours, in acute rheumatism, and the quantity is increased to ʒviij–x, or xij. *Charta Potassii Nitratis* (*Potassium Nitrate Paper*) consists of strips of white unsized paper immersed in solution of potassium nitrate (20 parts to 80 parts of distilled water). The inhalation of the fumes arising from the burning of these papers is used with advantage in spasmodic *asthma*.

Sodii Nitras (*Sodium Nitrate*, $NaNO_3$). This salt, commonly called *cubic nitre*, is found in large deposits in South America, chiefly in Peru, but also in Bolivia and Chili. The crude salt occurs in rather soft and pliable lumps, of white, yellow or gray color; it is often purified in Peru by solution, crystallization and desiccation, but it is usually refined after importation. It occurs in colorless rhombohedral crystals, slightly deliquescent, and wholly soluble in water, without odor, and of a sharp, cooling and bitter taste.

EFFECTS AND USES.—Sodium nitrate has been little used in medicine, its employment having been limited chiefly to *acute dysentery*, in which it is highly praised by German physicians, in amounts of from ℥ss–j, in mucilaginous solution, during the day. Its effects are analogous to those of potassium nitre. The sodium salts are not as powerful cardiac poisons, neither do they affect the temperature nor act on the nervous system to the same extent. They impede coagulation, but do not alter the blood-corpuscles.

REFRIGERANTS.

POTASSII CITRAS—POTASSIUM CITRATE.

This salt (formerly known as *Salt of Riverius*) is made by saturating a solution of citric acid with potassium bicarbonate, and evaporating to dryness. It is white, granular, inodorous, of a saline, slightly bitterish, but not unpleasant taste, deliquescent, and wholly soluble in water ($K_3C_6H_5O_7.H_2O$). It is an excellent refrigerant diaphoretic, much employed in *febrile affections*. Dose, gr. xx–xxv; ʒvj are usually dissolved in water Oss, and f℥ss of the solution is administered every hour or two. The salts of the alkalies with vegetable acids, as citrates, tartrates and acetates, during their passage through the body are converted into carbonates. To neutralize the urine in *renal calculi*, due to uric acid, ʒ½–j should be taken every three hours for two or three months.

Liquor Potassii Citratis (*Solution of Potassium Citrate*) may be made by dissolving separately citric acid 6 parts and potassium bicarbonate 8 parts in water enough to make the combined solutions weigh 100 parts; dose, f℥ss.

Mistura Potassii Citratis (*Mixture of Potassium Citrate*, or *Neutral Mixture*) is made by saturating fresh lemon-juice with potassium bicarbonate; or, when the lemon-juice cannot be had, a solution of citric acid, flavored with oil of lemon, may be used as a substitute. This preparation contains some free carbonic acid, which renders it more grateful to an irritable stomach than the ordinary solution of the citrate. Under the name of *effervescing draught* the potassium citrate is often prepared extemporaneously (fresh lemon-juice f℥ss with an equal measure of water, added to a solution of potassium carbonate ʒij in water f℥iv), and is given in the state of effervescence; it is an excellent remedy for *gastric irritability*, with fever.

LIQUOR AMMONII ACETATIS—SOLUTION OF AMMONIUM ACETATE.

This solution, termed also *Spiritus Mindereri*, or *Spirit of Mindererus*, is made by saturating diluted acetic acid with ammonium carbonate, and is a solution of ammonium acetate ($NH_4 C_2H_3O_2$). When pure it is a colorless liquid, with a saline taste; it should always be made freshly when dispensed. The physiological effects of the ammonium salts have already been considered (*vide* index). In small doses it is *refrigerant;* in larger doses, *diaphoretic* and *diuretic*. It is *employed* in *febrile* and *inflammatory* affections, sometimes in conjunction with nitre or one of the sedatives, sometimes combined with camphor and opium. Given in full doses, frequently repeated, it is one of the best means of removing the effects of *alcoholism*. Dose, f℥ss–j every two, three or four hours, in sweetened water.

SPIRITUS ÆTHERIS NITROSI—SPIRIT OF NITROUS ETHER.

This preparation, commonly known as *Sweet Spirit of Nitre*, is a solution of ethyl nitrite ($C_2H_5NO_2$) in alcohol. Spirit of nitrous ether is a volatile, inflammable liquid, of a pale-yellow color, inclining slightly to green, has a fragrant, ethereal odor, free from pungency, and a sharp, burning taste, and mixes with water and alcohol in all proportions; sp. gr. 0.823 to 0.825. It contains five per cent. of nitrous ether. It should not be long kept, as it becomes strongly acid by age.

Incompatibles.—Mucilage of acacia, antipyrine, and it liberates iodine in solutions of the iodides.

Toxicology.—The inhalation of sweet spirit of nitre has produced dangerous and even fatal effects: pallor of the face, livid discoloration of the lips and fingers, weakness of the pulse, muscular prostration, præcordial oppression, and headache are the symptoms described. The same symptoms may be produced by excessive doses. A case is recorded in which death was attributed to the inhalation of the ether from a broken bottle in a sleeping apartment.

Effects and Uses.—Sweet spirit of nitre is *antispasmodic*, *refrigerant*, *diaphoretic*, and *diuretic*. As a diaphoretic, small doses should be given, largely diluted and frequently repeated. It is much used in *febrile* affections, and, from its diuretic properties, is often combined with other diuretics in the treatment of *dropsies*. From its pleasant taste and smell it is very acceptable to children. Dose, fʒss–j, frequently repeated.

ACIDA VEGETABILIA—VEGETABLE ACIDS.

The vegetable acids are refrigerant, and, when properly diluted, form useful drinks in fevers, etc. Those chiefly employed are *acidum aceticum* (*acetic acid*), *acidum citricum* (*citric acid*), and *acidum tartaricum* (*tartaric acid*).

Incompatibles.—The alkaline hydrates, carbonates, and acid carbonates. The vegetable acids unite to form salts with the alkaline, earthy and metallic bases; the acetates of these are all soluble. Acetic acid forms red ferric acetate with tincture of ferric chloride.

Toxicology.—There are no recorded cases of poisoning with citric acid; tartaric ℥½ is *alleged* to have caused death in one instance; fatal results from acetic are rare.* The *antidotes* are the alkalies.

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* *Medical Press and Circular*, Nov. 17th, 1880, p. 417.

EFFECTS AND USES.—The following description is based on the investigations of H. Bence Jones[*] and F. Walter.[†] *Applied* to a raw surface or (if sufficiently concentrated) to the mucous membranes, they act as irritants. Acetic acid is the most powerful, and will, when applied to the skin, cause blanching, from contraction of the capillaries. Citric acid is the least irritant. *After large doses* the cardiac beat is slowed and weakened, but this is possibly due to the resulting gastro-enteritis. According to Walter they do not neutralize the alkalinity of the blood. It is unknown under what conditions they exist in this fluid. The general law regarding the action of acids on secretion holds good in the case of the vegetable acids, viz.: that when applied to the orifices of glands secreting an acid fluid they diminish, while when applied to glands secreting an alkaline fluid they increase their secreting power. Thus they augment the flow of saliva and the intestinal secretion. The ingestion of the vegetable acids increases the acidity of the urine. They also promote the excretion of both the water and the solids of the urine, particularly free uric acid (and may thus lead to calculus). They are probably converted into carbonic acid in the system, unite in part with bases to form salts, and are eliminated by the kidneys and intestinal mucous membrane. Their continued use causes abdominal pain, flatulence, and diarrhœa. In large doses they produce gastro-enteritis, and continued for a lengthy period they induce scorbutic symptoms.

Acetic Acid ($HC_2H_3O_2$) is employed *internally* only in the form of *diluted acetic acid* (strong acid 17 parts to distilled water 83 parts). *Externally*, strong acetic acid (sp. gr. 1.048, and containing 36 per cent. of monohydrated acid) or *glacial acetic acid* (nearly absolute acetic acid—sp. gr. 1.058) is employed as an escharotic to remove *warts* and in the cure of *lupus*. Acetic acid is less used internally as a refrigerant than citric acid, from its liability to produce colic and diarrhœa. Vinegar and water is one of the best injections for the cure of *gonorrhœa in the female*. Spongings with vinegar and water are useful to relieve the heat of the skin in *fevers*, to check *sweating*, as a wash in *urticaria*, and the vapor is grateful to the sick. Concentrated acetic acid is a corrosive poison, for which the alkalies and their carbonates, soap, etc., are the *antidotes*. CITRIC ACID

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[*] *Medical Times and Gazette*, Oct. 21st, 1854.

[†] *Arch. für Exper. Pathol. u. Pharm.*, 1877, p. 148.

($H_3C_6H_5O_7$) may be agreeably administered in the diluted juice of lemons, limes, sour oranges, and tamarinds. When these cannot be obtained, a solution of citric acid (gr. xx to water Oj) may be substituted. Citric acid is manufactured from lemon or lime-juice, by saturating it with calcium carbonate and afterward decomposing the calcium citrate which is formed, by the addition of sulphuric acid. It occurs in colorless crystals, having the form of rhomboidal prisms with dihedral summits, freely soluble in water, and soluble in alcohol; ʒixss, added to distilled water Oj, form a solution of the average strength of lemon-juice. In the dose of fʒj every hour or two, *lemon-juice*, *limonis succus* (the juice of the fruit of Citrus Limonum), has been employed with success in *acute rheumatism* and *gout*. Of late years, however, it has given place to more reliable modes of treatment. Properly diluted and mixed with sugar, it forms the delightful refrigerant known as lemonade. Lemon-juice (or, still better, lime-juice) is the most efficient known remedy for *scurvy*, and it is almost infallible as a prophylactic against this malady. It has also proved of advantage in *jaundice* and *torpor of the liver*. *Syrup of citric acid* consists of citric acid (8 parts) and water (8 parts) with oil of lemon (4 parts) and syrup (980 parts). *Lemon-syrup*, which is pleasanter, is made by heating lemon-juice (40 parts) to the boiling point, adding lemon-peel (2 parts) and letting it stand until cool; then filter and add enough water to make the filtrate weigh 40 parts; dissolve sugar (60 parts) in the filtrate and strain. *Spirit of lemon* (sometimes called *essence of lemon*) is made by dissolving *oil of lemon* 6 parts (obtained from the *rind of the fruit*), in alcohol 90 parts, and adding freshly-grated lemon-peel 4 parts; dose, fʒj–ij. TARTARIC ACID ($H_2C_4H_4O_6$) is the acid of grapes, and is extracted from tartar or crude cream of tartar. It is a white crystallized solid, in the form of irregular six-sided prisms, and is found in the shops as a fine white powder, soluble in water and alcohol. Being cheaper than citric acid, it may be used as a substitute for that acid. It is employed in making *Seidlitz powders*. Tartaric acid in excess yields a precipitate (cream of tartar) with a solution of carbonate or other neutral salt of potassium, while citric acid yields none.

ORDER VIII.——SPINANTS.

Under the term Spinants, or Spastics, are comprised medicines which are employed to excite muscular contraction, or whose ultimate effect is the production of motor-paralysis, and may, accordingly, be divided into EXCITO-MOTORS and DEPRESSO-MOTORS. Of the *first* class, the most important articles are vegetable substances containing the alkaloids strychnine and brucine, which are employed therapeutically in torpid or paralytic conditions of the muscular system; ergot, which is used to excite muscular contraction of the uterus; and digitalis, which is given for its tonic effect on the heart. Paramorphine is also an excito-motor agent (see p. 82). The *second* class contains such remedies as conium, physostigma, woorara, etc.

EXCITO-MOTORS.

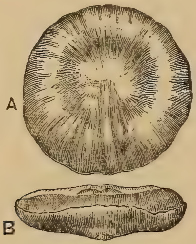
NUX VOMICA.

Strychnos Nux vomica, or Poison-Nut (*Nat. Ord.* Loganiaceæ), is a middling-sized tree of the coast of Coromandel and other parts of India, which bears a round, smooth berry, the size of a pretty large apple, of a rich orange color, and containing numerous seed imbedded in a juicy pulp. The SEED are the official portion; but the bark also is poisonous, and is known as *false angustura bark*, from its having been confounded with angustura bark. The seed are round, peltate, less than an inch in diameter, nearly flat, or convex on one side and concave on the other, and surrounded by a narrow annular stria. They have two coats: a simple fibrous outer coat, covered with short, silky hairs, of a gray or yellowish color, and a very thin inner coat which envelops the nucleus or kernel. This is hard, horny, of a whitish or yellowish color, and of very difficult pulverization. The seed have no odor, but an intensely bitter taste, which is stronger in the kernel than in the investing membrane.

CHEMICAL CONSTITUENTS AND TESTS.—They impart their virtues to water, but more readily to diluted alcohol, and contain two active alkaloids, *strychnine* (official) and *brucine*, both of which exist in combination with an acid called *igasuric*; another alkaloid, termed *igasurine*, much more soluble in water than the two first named, has been lately extracted from nux vomica; also *loganin*.

Strychnina (*Strychnine*) ($C_{21}H_{22}N_2O_2$) is obtained by the following process: Nux vomica is digested and boiled in water acidulated with hydrochloric acid, and the resulting strychnine and brucine hydrochlorate is decomposed by milk of lime. The strychnine is separated from brucine and impurities by boiling alcohol, from which it is deposited when cool, the brucine being left in solution. It is then converted into a sulphate by the addition of diluted sulphuric acid, next decolorized by purified animal charcoal, and again precipitated by solution of ammonia. Thus obtained, it occurs as a white or grayish-white powder (but may be made to crystallize in the form of white, brilliant rhombic prisms), of an intensely bitter taste, almost insoluble in water, slightly soluble in cold alcohol, but readily soluble in boiling alcohol. A very delicate *test* for strychnine is the potassium bichromate: this, added to a solution of strychnine in concentrated sulphuric acid, produces a violet color, which after a time changes to wine-red, and then to reddish-yellow. Lead binoxide, manganese peroxide, potassium ferrocyanide and permanganate act in the same way. In these tests the reagent is nascent oxygen. The presence of morphine in excess, of certain undefined organic substances,* and of curare, may disguise the color-test; here an alkaline mixture of chloroform should be used to separate the strychnine from morphine; while curare can be distinguished by its amorphous state. The physiological test should be always resorted to: if a small frog be placed in an ounce of water cotaining $\frac{1}{100}$ of a grain of a strychnine salt, in two or three hours it will undergo tetanic spasms, and soon die.

FIG. 21.



STRYCHNOS NUX VOMICA. A. B. SEEDS.

Brucine ($C_{23}H_{26}N_2O_4$, not official) resembles strychnine in its action (Mays †). It differs from it in being *locally* analgesic and often destroying life without a trace of spasm. It the case of an adult ‡ gr. ij induced convulsions which were counteracted by chloral. The dose is gr. ¼–½.

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[*] "Micro-Chemistry of Poisons," 1885, p. 569.

[†] Pamphlet, "The Differential Action of Brucine and of Strychnine," Phila., March, 1887.

[‡] *Med. and Surg. Reporter*, 1882, 194.

INCOMPATIBLES.—Tannic acid, the iodides, chlorides, and bromides yield precipitates with strychnia; the strychnia bromide forms only after standing and can be prevented by dilute HCl.

AIDS.—Electricity, picrotoxin, ergot, ustilago, and ignatia.

PHYSIOLOGICAL EFFECTS.—Nux vomica or its alkaloid, strychnine, increases the reflex excitability of the spinal cord, and thus favors the production of convulsions. Its action seems to be especially directed to excitation of the spinal motor-centres. Klapp * affirms that even lethal quantities in the frog have no action on the sensory or motor nerve-endings, nor upon their trunks. This statement, however, is denied by Vulpian † and others. After death, galvanization of the motor-trunks causes little or no contraction in response, due to direct action on, and exhaustion of the motor-trunks. It stimulates the vaso-motor centres of the brain and spinal cord (Ott), and also the respiratory centre. Large doses paralyze these centres at once (Klapp), but the vagi are not affected either in warm- or cold-blooded animals. Death is due to asphyxia. In very *small* and *repeated* doses it has a tonic and diuretic effect, and sometimes operates slightly on the bowels and skin, but it has no effect on the circulation. It is said to be eliminated by the kidneys unaltered. In *somewhat larger doses*, the stomach is often disturbed, the cardiac action is accelerated from stimulation of the cardiac ganglia, the visual sense is rendered more acute and the retina becomes hyperemic, and in still larger doses, the muscular system becomes disordered. A sense of weight and weakness in the limbs, and increased sensibility to external impressions of all kinds, manifest themselves, with depression of spirits and anxiety; the limbs tremble, and slight convulsive movements of the muscles appear. If the medicine be *continued*, or if a *toxic dose* be taken, convulsive paroxysms of the whole muscular system ensue, with erotic desires, painful sensations in the skin, and occasionally eruptions; the heart is slowed, and the blood-pressure increased, probably through vaso-motor spasm. In paralytic patients the effects of the medicine are principally observed in the paralyzed parts. When taken in excessive doses the symptoms usually come on suddenly, and within half an hour, and consist of paroxysms commencing with a sudden shuddering, quickly passing into a tetanic convulsion of all the voluntary muscles. The body is bent backward until the occiput and heels support its weight (*opisthotonus*), the corners of the mouth are drawn up in a ghastly grin (*risus sardonicus*), and the face, at first pale, becomes livid as the paroxysm continues, from interference with respiration. Trismus (an early symptom in tetanus) occurs finally in severe cases. After a variable time the muscles relax and an interval of quiet succeeds, during which there is sometimes a slight rigidity of the muscles, but no marked stiffness as in tetanus. As a rule the paroxysms are painful.

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* *The Journ. of Ment. and Nerv. Dis.*, Oct., 1878, p. 619. "Physiological Action of Strychnine on the Brain, Spinal Cord and Nerves."

† *Arch. de Physiologie Norm. et Path.*, III, 1870, 116. "Remarques touchant l'action de la strychnine sur les grenouilles."

Toxicology.—If the dose has been sufficient to cause death, the paroxysms rapidly succeed one another, increasing progressively in severity and duration until dissolution occurs from fixation of the muscles of respiration, the intellect being usually unaffected up to the fatal termination. The convulsions resulting from the use of strychnine are of *spinal origin*; and are due to an exaltation of the reflex functions together with a stimulation of the motor-cells of the cord. The reflex centres are in such an irritable condition that the slightest irritation of the surface, as by a breath of air, will produce a convulsion. The poisonous dose of strychnia varies widely, as a case * is reported (that of Dr. Warner) in which gr. ½ killed an adult in twenty minutes, while recovery followed in a soldier † who had taken about gr. xv.

Antidotes.—There is no chemical antidote, unless, perhaps, it be tannic acid, which forms an insoluble tannate. The patient is to be kept perfectly quiet and all sources of irritation, as draughts or loud noises, should be excluded as likely to cause a tetanic paroxysm. The stomach should be emptied and the physiological antidote, *chloral*, given. It ‡ acts chiefly by lowering the activity of the parts which conduct the excitation to the spinal cord, preventing the too frequent repetition of the tetanic spasms and lessening their intensity. In grave cases artificial respiration should also be resorted to. Some relief is afforded by holding the limbs or even by applying friction to them, during the paroxysm. The antidotism between strychnine and chloral is not reciprocal. Opium, conium, ether, chloroform, Calabar bean or potassium bromide, may also be exhibited as physiological antidotes. Recently Prof. Anrep * has called attention to urethan as a physiological antidote to strychnine and other tetanizers.

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* *Guy's Hosp. Reports*, XI, p. 296.

† *Medico-Legal Journal*, Parker, 1885, p. 375.

‡ *Schmidt's Jahrb.*, June, 1881, quoted by *Am. J. M. Sci.*, April, 1882.

MEDICINAL USES.—This medicine is our chief resource in torpid or paralytic conditions of the motor or sensitive nerves, or of the muscular fibre. When, however, paralysis is the result of inflammation of the nervous centres, it is injurious, and accelerates organic changes. It is most beneficial in those forms of *paralysis* which are independent of structural lesion, as *lead palsy* or paralysis from *alcoholism*. In paralysis arising from *apoplexy*, as *hemiplegia*—after the absorption of the effused blood, when the paralysis remains, as it were, from habit—the cautious employment of nux vomica is often attended with advantage. In *amaurosis*, free from cerebral complication, especially when due to alcohol or tobacco, it is very useful. In these cases strychnine is recommended in doses of gr. $\frac{1}{30}$ injected into the corresponding temporal region. It should be administered daily, and the dose increased until slight twitchings of the muscles are produced. In atrophy of the optic nerve-fibres, it has not met with the success which was predicted, but is of undoubted service before the stage of atrophy is reached. It has also been found very beneficial in chronic *constipation*, either alone or as an adjunct to cathartics: ℞ Resinæ podophylli, gr. iij; extracti colocynthidis compositi, gr. xij; extracti nucis vomicæ, gr. vj; extracti hyoscyami, gr. xxiv. M. et ft. pil. xxiv. Sig.—Take one pill once, twice or three times a day, as necessary. ℞ Aloin, gr. ij; strychninæ sulphatis, gr. $\frac{1}{3}$; extracti belladonnæ alcoholici, gr. j. M. et ft. pil. xxiv. Sig.—One pill after each meal, three times a day. As an aphrodisiac in *impotence*, in *incontinence of urine*, *spermatorrhœa*, and other affections depending on functional atony and relaxation of muscular fibres, it is often highly serviceable; in *dyspnœa* due to chronic bronchitis, dilated bronchi, emphysema, or incipient phthisis, it is of value as a respiratory stimulant; it may be advantageously combined with digitalis when dyspnœa is due to cardiac disease, acting not only as a respiratory, but also as a cardiac stimulant; and in pure *cardiac dilation* it is well to alternate strychnine (gr. $\frac{1}{60}$) with digitalis, giving either for a week or two at a time; and lastly, in combination with other remedies, as iron, in anemia and chlorosis: ℞ Strychninæ sulphatis, gr. $\frac{1}{3}$–$\frac{1}{2}$; tincturæ ferri chloridi, fʒij–iv; acidi acetici diluti, fʒj; liquoris ammonii acetatis, f℥iij; elixir aurantii, ad f℥vj. M. et S.—Two teaspoonfuls, largely diluted, three times a day, after meals. ℞ Ferri sulphatis exsiccati, gr. xx–ʒss; quininæ sulphatis, gr. xl; strychninæ sulphatis, gr. ss., mannæ q. s. M. ft. pil. xx. S.—One t. d. In small doses it has been used with excellent effect as a general tonic where there is loss of nerve-power, and as a stomachic in *dyspepsia*, *anorexia*, and to relieve the *vomiting of pregnancy*, for which purpose the tincture may be given in ♏¼–j doses, repeated several times at intervals of half an hour.

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* *Bull. Gén. de Thérap.*, Feb. 15th, 1887. Quoted.

In the treatment of the symptoms induced by *alcoholismus*, Dobrowravow * reports good results from the hypodermic injection of strychnia, his observations extending over forty cases.

Administration.—Dose of the powder, gr. ij or iij, in pill, several times a day, and increased till an effect is produced; of the *abstract*, gr. ss–ij; of the *extract* (alcoholic) gr. ss–j, to be repeated and increased; of the *fluid extract*, ♏j–v; of the *tincture*, gtt. v to xx, and this is sometimes used as an embrocation to paralyzed parts. A tolerance of nux vomica and strychnine is rapidly established in the system.

Strychnina (*Strychnine*). The preparation and tests for this alkaloid have already been considered.

The *effects* of strychnine are similar to those of nux vomica but more violent; its *local* action is that of an irritant. It is employed for the same purposes as nux vomica, and should be given in very minute doses, as gr. $\frac{1}{32}$–$\frac{1}{16}$ to begin with, to be gradually increased, carefully watching the patient and suspending its administration as soon as twitching of the muscles, or an approach to the *risus sardonicus*, is observed. The *salts of strychnine* may be also employed in the same doses, and as they are more soluble than the alkaloid, they are more active. For *endermic* use, gr. $\frac{1}{40}$ of the alkaloid may be used; when given hypodermically, as in *amaurosis*, dose, gr. $\frac{1}{60}$ to begin with. The salts are preferred for hypodermic use, because of their greater solubility.

Strychninæ Sulphas (*Strychnine Sulphate*) is made by dissolving a mixture of strychnine in distilled water, with diluted sulphuric acid and evaporating. It occurs as a white salt, in colorless prismatic crystals, efflorescent, odorless, very bitter, readily soluble in water, sparingly soluble in alcohol, and insoluble in ether. It responds to the tests for strychnine, and may be used for the same purposes and in the same doses.

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* *Bull. Gén. de Thérap.*, Dec. 15ième, 1887, quoted.

IGNATIA.

The SEED of Strychnos Ignatii, or St. Ignatius' Bean (*Nat. Ord.* Loganiaceæ), a tree of the Philippine Islands, contains a large proportion of *strychnine*, some *brucine*, etc., and possesses medicinal properties analogous to those of nux vomica. It may be given to fulfill the same remedial indications as nux vomica. An *abstract* (dose, gr. ¼–j) and a *tincture* (dose, ♏v–xx) are official.

HYDRASTIS.

The RHIZOME and ROOTLETS of Hydrastis canadensis, Yellow Root or Golden Seal (*Nat. Ord.* Ranunculaceæ), a small indigenous plant, with yellow, fugacious flowers, and a red fruit resembling raspberries, has from recent experiments been classed among the excito-motors. It contains the alkaloids *hydrastine* ($C_{21}H_{21}NO_6$), *berberine* ($C_{20}H_{17}NO_4$), and *xanthopuccine*,* which is simply impure berberine; also *starch, sugar*, etc. (Maisch).

PHYSIOLOGICAL EFFECTS.—According to A. J. Slavatinski,† when hydrastine is given hypodermically to frogs in small doses (.001–.002 gm.) it causes incoördination of movements, general sluggishness and weakness, quickened respiration, and a reduction of the cardiac frequency from $\frac{1}{3}$–$\frac{1}{2}$ of the normal rate, and at the same time the individual contractions are very energetic. When a larger dose (.003–.005 gm.) is given, general convulsions occur (resembling those caused by strychnine), which disappear on section of the spinal cord. The effects on the heart are intensified, and the cardiac action is interrupted by diastolic arrests. If a still larger amount (.005–.01 gm.) be given, the convulsions are followed by prostration, paralysis and death, the heart stopping in diastole. When placed on the cut-out heart, the cardiac action stopped and the heart could not be made to respond to further irritation. It probably acts on the heart not only through the par vagum, but also through the cardiac ganglia, and in large doses, paralyzes the cardiac muscle directly. It stimulates the reflex centres of the cord, exalts the irritability of the motor-nerves, and probably depresses the end-organs of the sensory nerves. Given to warm-blooded animals it slows the cardiac action, produces general depression, dis-coördination and incessant tremor; large doses cause death, which is due to tetanus of the respiratory muscles, and is preceded by general paralysis. The action of hydrastis is less powerful but of longer duration than that of strychnine, which it resembles. It acts, also, as a diuretic, and according to Rutherford, it is an hepatic stimulant of considerable power, and a feeble intestinal excitant. According to Givopiszew* hydrastis always provokes uterine contractions, which are less intense than those of ergot.

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* *Proc.* Amer. Pharm. Associat., 1884, p. 456; F. B. Power.

† *Meditz Obozr.*, Nov. 16, 1884, p. 346; quoted by *Lond. Med. Rec.*, Nov. 15th, 1884, p. 498.

MEDICINAL USES.—It is recommended as a nerve-tonic and anti-fermentative in atonic *dyspepsia* and *chronic gastritis*. From its action on the liver and intestines it is useful in *duodenal catarrh*, *catarrhal jaundice*, and *constipation* due to deficent secretion. It is an efficient diuretic, and has been used for this purpose in promoting the discharge of *renal calculi* from the kidneys. It is also prescribed in *chronic cystitis*, and has been employed internally and by injection for the cure of *gonorrhœa*, in the stages of decline, and in *gleet*, and also as an injection in uterine and vaginal *leucorrhœas*. It is an excellent remedy against *uterine hemorrhage* due to inflammation of the organ, coincident with the menopause or too abundant flow at the monthly period (Givopiszew, *loc. cit.*). From the study of its effects, it should be useful in the same class of cases in which strychnine is employed.

ADMINISTRATION.—Dose, of the *fluid extract*, f℥j-iv; as a stomachic tonic, ♏v-xv before meals. The *tincture* may be given in doses of ♏x-f℥j, t. d.

As an injection in *gonorrhœa*, hydrastine may be used in the strength of gr. x-xv to mucilage f℥j.

Rhus Toxicodendron (*Poison-Oak*). The FRESH LEAVES of Rhus toxicodendron, or Poison-Oak (*Nat. Ord.* Terebinthaceæ), an indigenous shrub from one to three feet high. Other species of Rhus, possess properties somewhat analogous to those of nux vomica, and have been employed with success in *paralysis*. They contain *toxicodendric acid*, to which their poisonous and medicinal activity is due. Dose, gr. j-iij, or more, to be repeated and increased. In cases of *poisoning*, the irritation of the skin is relieved by glycerite of carbolic acid or alkaline solutions.

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* Thèse, St. Petersburg, 1887, quoted by *Bull. Gén. de Thérap.*, CXIV, 189.

COCCULUS INDICUS.

Cocculus indicus (not official) is the DRIED SEED of Anamirta paniculata (*Nat. Ord.* Menispermaceæ), a climbing shrub of India. The fruit is a one-celled berry, of a dark purplish color, with a soft pulp, and a single *seed* the size of a pea, containing a bitter kernel. The active properties reside in a peculiar white, crystallizable bitter principle which is official under the name of PICROTOXINUM (*picrotoxin*, $C_9H_{10}O_4$). It is partially soluble in water, and very soluble in alcohol, chloroform and ether, and in a mixture of acetic acid and water. Picrotoxin is not precipitated by the reagents for the alkaloids, and does not neutralize acids. In the shell, an alkaloid termed *menispermine* has been found, and a neutral principle of the same composition as the alkaloid, termed *paramenispermin.*

AIDS.—The spinants, as strychnine, brucine, and ergot. In its action on the secretions, it is allied to pilocarpia and muscarine.

EFFECTS AND USES.—*Picrotoxin* is an acrid cerebro-spinal narcotic, capable, in large doses, of producing death by tetanic fixation of the respiratory muscles. Its cerebral effects are variously described, such as stupor, giddiness and vertigo. In doses sufficient to produce these effects it is apt to nauseate. It is a tetanizing agent, the tetanus being followed by convulsions, paralysis and coma. According to Chirone* the chief action of the drug appears to be that of an excitant of the centres located in the medulla oblongata and spinal cord. The convulsions can be brought on in an animal from which the brain has been removed. Picrotoxin is capable of originating an artificial epilepsy, and it acts independently of the psycho-motor centres, its influence being most decided when they are removed. During the conclusive stage the heart's action increases, while in the stage of coma it becomes slow, and after death it is found to be in diastole. Picrotoxin induces decided diaphoresis. In rare instances it has destroyed human life. In cases of poisoning by picrotoxin, chloral, ether by inhalation, and the motor-depressants are to be given. It has not been much used *internally*, except in the *night-sweats* of phthisis, for which Murrell† recommends it, in doses of gr. $\frac{1}{180}$ to $\frac{1}{60}$, but in the form of decoction or ointment it is employed to destroy *pediculi* and other parasites, and for the cure of *tinea capitis* and *porrigo* of the scalp. It is said to prevent the secondary fermentation of malt-liquors, into which it is sometimes introduced as an adulteration.

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* *Annali Univer. di Med. e Chirurgia*, vol. 251, 1880, p. 289. Ricerche sperimentali sull'azione biologica della picrotoxina; per V. Chirone.

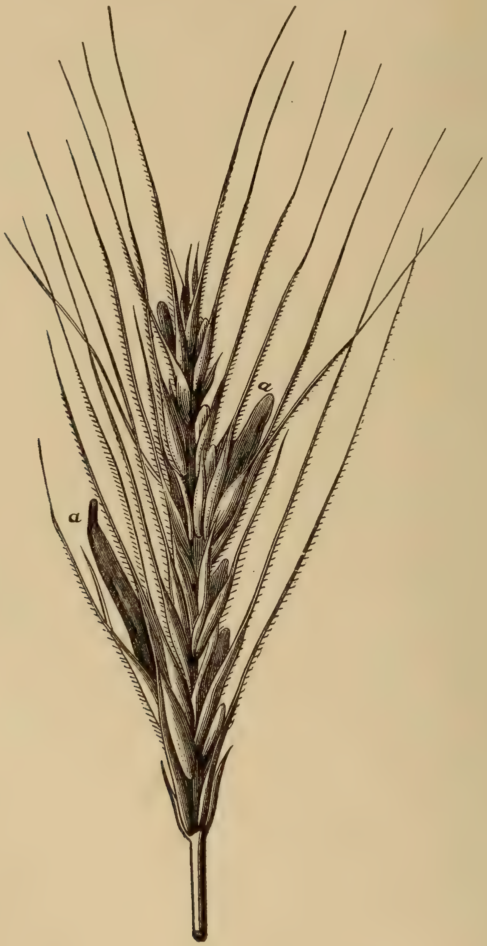
† *Lancet*, London, 1890.

ERGOTA——ERGOT.

Ergot is a fungus growing from the diseased ovary of Secale cereale, or Rye (*Nat. Ord.* Graminaceæ). The U. S. Pharmacopœia styles it the SCLEROTIUM OF CLAVICEPS PURPUREA (*Nat. Ord.* Fungi), replacing the grain of Secale cereale. In the production of ergot there are three stages, as follows: 1st, in the flowering season one or more ovaries in an ear of rye are covered by a sweet yellowish mucus—the honey dew of rye—which contains numerous microscopic cells called *conidia*, a sugar, and which is the product of the decomposition of the constituents of the ovary caused by the developing *mycelium* of the fungus. This is formed of filamentous cells termed *hyphæ*, and the first stage ends when the hyphæ have penetrated the ovary and separation of the conidia have ceased. 2d, when the hyphæ unite at the base of the ovary into a purplish-black body (ergot) extending to the apex of the grain. 3d, the development of the fungus is completed. It will be seen that ergot is the dormant or intermediate stage of a fungus called Sclerotium, compound mycelium or spawn. Its predisposing cause is unknown, and it is not peculiar to rye, many other grasses being subject to it, as abortion in grazing animals has been frequently produced by their eating grasses affected with ergot. The ergot usually projects out of the glum or husk of the plant, beyond the ordinary outline of the spike or ear. It should not be collected until some days after it has begun to form, as it is thought not to possess full activity until about the sixth day of its formation. As found in the shops it consists of cylindrical or somewhat prismatical tapering grains, curved like the spur of a cock, of a purplish color externally, and of a yellowish or grayish-white color within. Its smell is peculiar and nauseous; its taste is at first faint, but becomes bitterish, acrid and disagreeable. It yields its virtues to water and alcohol, and does not keep well, being liable to the attacks of a minute worm. It deteriorates much more rapidly in powder than when in grain, in the former condition soon becoming inert.

CHEMICAL CONSTITUENTS.—Numerous analyses have been made of ergot, but there is still some uncertainty as regards its active principles, though this is gradually growing less. The investigations of Dragendorff seem to show that the specific effects of the drug depend in a high degree upon a proximate principle of an acid character, to which the name of *sclerotic acid* is given: this, however, has not been confirmed. It is odorless and tasteless, soluble in water and boiling alcohol, but not at all in cold alcohol. Good ergot contains from 4 to 4.5 per cent. of the acid. The most reli-

FIG. 22.



SECALE CEREALE. A. A. ERGOT.

able investigations upon this question are those of Kobert,* which point to the following conclusions: viz., that ergot does not owe its ecbolic power to ergotinic acid, which has no influence on the uterus, but that *sphacelinic acid*, a resinous body insoluble in water, never failed to produce powerful contractions in the gravid uterus, and lastly that *cornutin*, gr. ⅛, either in the pregnant or non-pregnant uterus, always exhibited the same action. According to this observer, the only active preparation is one containing both cornutin and sphacelinic acid, and that no sample of ergot, either European or American, retained its virtues for more than 12 months. Ergot also contains *scleromucin* (2 to 3 per cent.), *sclererytherin*, *scleroiodin*, *picrosclerotin* (poisonous), *sclerocrystallin*, and *scleroxanthin* (inert), and an alkaloid, *ergotinine* (Maisch).

INCOMPATIBLES.—Forms a clear solution with liquor potassæ; tannin throws down a copious precipitate; with ferric chloride its solution is much darkened.

AIDS.—Ustilago and gossypium enhance its action of contraction upon the uterus.

PHYSIOLOGICAL EFFECTS.—The effects of ergot are not well understood, especially as regards its action on the nervous system. In medicinal doses it acts most conspicuously on the circulation and on the female system, in which it excites powerful contractions of the uterus. *After labor has commenced*, in ten or twenty minutes from its administration, it increases the violence, frequency and continuance of labor-pains, which usually never cease until the child is born. Administered *before labor*, it frequently originates the process, though its effects in this respect are less constant. And even in the *unimpregnated uterus* it produces painful contractions, and evinces an influence over morbid conditions of the organ by checking uterine hemorrhage and expelling polypi. Ergot induces † contraction of the unstriped muscular fibre wherever found, causing a shrinkage in the calibre of the blood-vessels *everywhere*, and it is thus available generally as a remedy in cerebral and spinal congestions, hemorrhages, tumors, morbid growths and enlargements. In large doses it produces vomiting, purging, increased peristalsis, and a marked sedative[*] effect on the circulation, slowing the heart (10–36 beats), probably by direct action on the cardiac muscle, and causing an enormous rise in the blood-pressure, through the contraction of the arterioles and stimulation of the vaso-motor centres of the cord and medulla; decided toxic doses lower the blood-pressure, by depressing the heart and vaso-motor centres (Brown-Séquard). In excessive quantities it acts as an acro-narcotic poison on both sexes. When it is used for a length of time as an article of food it produces a peculiar morbid condition, termed *ergotism*, which assumes two forms, one attended with convulsions, the other with dry gangrene of the limbs.

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* *The Practitioner*, Dec., 1885, p. 414: and *Arch. für Exp. Pathol. u. Pharmakol.*, 1884, XVII, p. 316.

† *Arch. de Physiol. Norm. et Pathol.*, iii, 1870, p. 584. Effets de l' extrait d'ergot sur la pression artérielle; par Ch. L. Holmes.

MEDICINAL USES.—From its action on the pregnant uterus, ergot has long been used in obstetric practice. With few exceptions ergot had better not be administered while any product of conception remains within the uterine cavity, because, while causing contraction of the muscular fibres of the fundus, which would produce expulsion of the uterine contents, it also causes contraction of the sphincter-like fibres of the cervix, and thus presents an obstacle to the emptying of the uterus. As the intermittent contractions of the uterus become continuous and tetanic under the influence of a large dose of ergot, it is obvious that rupture of the uterus may occur if the resistance offered to the expulsion of the uterine contents be sufficiently great. Partly on this account, and partly because the tetanic contraction of the uterus induced by ergot would interfere with the circulation of the fœtus, it should never be administered during the first stage of *labor.* During the second stage of labor, it may be given if the expulsive pains are feeble and inefficient (uterine inertia), when there is a *proper conformation of the pelvis and soft parts, when the os uteri, vagina, and os externum are dilated or readily dilatable, and when the presentation of the child is such as to offer no great mechanical impediment to speedy delivery.* In these cases it is best to administer it in small doses (♏viij–x of the fluid extract), as when thus given it simply intensifies the natural uterine contractions without causing them to become continuous. It has also been used in the second stage of labor in women subject to flooding, given just before delivery, but even in these cases it is better to withhold the drug until the placenta is expelled, as otherwise the uniform contraction induced may lead to its retention.

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[*] *Bull. Gén. de Thérap.*, lxxviii, pp. 433, 481. Ergot, ergotine, action physiol., etc. M. Bailley.

After the third stage of labor is completed, if *hemorrhage* is likely to occur from uterine inertia, ergot is one of the best remedies we possess, as the tetanic contractions which it produces permanently arrest the bleeding by compressing the orifices of the vessels. Ergot exercises a dangerous sedative influence on the *child* during labor (owing to the interference of the passage of blood from the placenta during violent uterine contraction), and its use may sometimes produce fœtal death, if the obstetrician is not careful to listen frequently to the fœtal heart, and deliver with the forceps should any sign of asphyxia be present (Spiegelberg). It has been used in the hemorrhage due to *abortion*, but as the bleeding will only stop when the uterine cavity is empty, and as ergot delays this by preventing dilatation of the cervix, the tampon and other means are preferable. When, after an abortion, the placenta is retained by adhesions so firm that it is impossible to destroy them, a tampon may be employed and ergot given simultaneously.

Ergot has also been used to cause the expulsion of polypi, and even of interstitial *fibroids* from the uterus. In speaking of its administration in the latter class of tumors, Emmet* says: It should never be given in large doses until after the uterine canal has been dilated, and until it is found that the tumor projects sufficiently to warrant the belief that it may become pedunculated by uterine contraction." By neglecting these cautions he has seen peritonitis produced. It is best to administer it hypodermically in these cases. In *subinvolution*, especially when menorrhagia is present, ergot combined with potassium bromide is useful. For its action on unstriped muscular fibres it is much employed in *hemorrhage* generally; in congestive *dysmenorrhœa; hematuria; paralysis of the bladder*, especially when due to over-distention; *purpura;* and *diabetes insipidus;* by hypodermic injection, in the cure of *aneurism* and varix, and as a means of checking *hemoptysis.* It is also used in *intestinal* and *uterine hemorrhage.* In *hematemesis* it may also be employed, but is inferior to other remedies. In *paralysis* dependent upon congestion of the spinal cord as in *spinal menigitis,* and in *acute myelitis,* it is often of great service.

Administration.—Ergot may be given in labor, in the dose of gr. v–xx, in powder, every twenty minutes, till its effects are produced, or three doses are taken: in other diseases the dose is from gr. iij–x. It may be safely given, in chronic diseases, for a long period, without danger of ergotism; the indication of the maximum dose having been reached in the female is the production of uterine colic, when the quantity should be diminished. The *fluid extract* is the best preparation; dose, ♏v–f℥j or more.* The *extract* is made by the evaporation of 500 parts of fluid extract over a water-bath at a temperature not exceeding 122° F. until it is reduced to 100 parts; dose, gr. v–xv. The *wine* (*vinum ergotæ*) contains powdered ergot, 15 parts, in 100 parts by weight of the preparation. Dose, f℥j–iv. The preparations used under the name of *ergotine* are of uncertain strength.

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* "Princip. and Practice of Gynæcol." 3d ed., p. 567.

USTILAGO.

Ustilago maydis (*Nat. Ord.* Fungi), Corn-Smut or Corn-Ergot, is a fungoid growth upon the Zea Mays or Indian Corn (*Nat. Ord.* Graminaceæ). It has been known to exist for more than one hundred years, having been described by Pujol† in the last century. It is found in irregular masses in the Northern States,‡ during the middle and latter part of summer, growing most frequently upon the young ears and tassels, the leaves being usually exempt, and consisting of a blackish gelatinous membrane, inclosing numerous dark globular and nodular spores, which break up like a great puff-ball, discharging a cloud of brownish impalpable dust of narcotic odor. It has a disagreeable odor and taste, and contains a *fixed oil*, probably *sclerotic acid*, a *crystalline principle*, etc. (Maisch).

AIDS.—Upon the uterus, ergot and gossypium.

EFFECTS AND USES.—J. Mitchell§ has investigated its action upon frogs with the following results: By injection it induces tremors and clonic spasms; increased doses cause irregular respiration, weakened muscular movements, spasms, palsy and death, the latter due to paralysis of respiration; the heart continues to beat after life is apparently extinct. Lethal amounts abolish all movements, suspend reflex action, and contract the pupils. The suspension of reflex action is due to paralysis of the sensory part of the cord, though the motor-tracts, too, are depressed. No statement of its action on muscular fibre of either kind has been come across, though Dr. Steel* noticed that abortion was common in cows when turned into fields to feed, unless the corn smut had been removed, which indicates an action of contraction upon the muscular structure of the uterus.

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* For hypodermic use, the fluid extract should be reduced by evaporation to one-sixth of its weight, and sixty grains of this extract should be dissolved in four fluidrachms of water; four minims of this aqueous solution represent one grain of extract and six grains of ergot; or the fluid extract may be carefully filtered, and used in doses of ♏x; or the extract may be dissolved in water and filtered; it is five times as strong as the fluid extract.

† *Journ. de Médecine*, 1774, 1, p. 145.

‡ *Therap. Gaz.*, 1881. Prof. Spalding.

§ *Ibidem*, 1886, p. 223.

The *uses* of ustilago resemble those of ergot, and it has been successfully employed in the same class of cases. (Midwifery—Drs. Vernon † and Rouse. ‡) Dose of the fluid extract (not official), gtt. x–xx.

GOSSYPII RADICIS CORTEX--BARK OF COTTON ROOT.

Gossypium herbaceum (*Nat. Ord.* Malvaceæ) is a native of Asia, cultivated extensively in tropical and semi-tropical countries, and with great success in the South Atlantic and Gulf districts of the United States. By cultivation, different varieties of this plant have been produced. The root should be collected immediately after the cotton is harvested, and the ROOT-BARK should be of a yellowish-brown color externally, internally much lighter; when chewed, it has a slightly sweetish, astringent taste. It contains *chromogene* (when fresh), becoming a red resin, a *yellow resinous coloring matter*, *fixed oil*, *gum*, *sugar*, *tannic acid*, etc.

AIDS.—Upon the uterus ergot and ustilago.

EFFECTS AND USES.—Gossypium has long been recognized by Southern physicians as possessing a decided influence in exciting uterine contractions. Dr. J. C. Martin, § from experiments on frogs, rabbits, and guinea-pigs, concludes that it has no action on the motor or sensory nerves, nor on the reflex functions, and that the circulation and muscles are uninfluenced by it.

The most recent investigations, furthermore, show that in large doses it kills by paralysis of respiration, often preceded by clonic convulsions not prevented by section of the cord; the reflex centres of the cord are depressed, but the motor and sensory nerves are not affected. The blood-pressure falls, from depression or paralysis of the vaso-motor centres, this fall being preceded by a rise in pressure if the dose be small. In large amounts it causes great venous congestion and tension, stimulates and then paralyzes the cardio-inhibitory apparatus and depresses the cardio-motor ganglia, thus at first retarding and then accelerating the pulse, which is always weakened. The pupil is always dilated. It stimulates muscular action, especially that of the unstriated variety. It often causes vomiting and purging. In cats and rabbits, gossypium causes, in small and repeated doses, intermittent rhythmical contractions of the gravid uterus, leading to complete expulsion of its contents, and it has been seen to increase the uterine contractions when administered after their inception.* Prochovnik finds it an efficient substitute for ergot, although its expulsive power is not so great. He recommends it especially in hemorrhage after *abortion*, and in *uterine myoma*. The only official preparation is the *fluid extract* (which, when first prepared, is of a brownish-yellow color, changing, however, to a bright red); dose, f℥ss.

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* *Trans.* Wisconsin State Med. Society, 1878, p. 127.

† *Chicago Med. Times*, II, 1879–80, p 434.

‡ *Therap. Gaz.*, 1886, p. 163.

§ *Am. Journ. Med. Sciences*, Jan., 1882. An investigation of the physiological effects of Gossypium Herbaceum.

Gossypium (*Cotton*), the well-known filamentous substance separated from the seed of the varieties of gossypium, is a useful application to *burns* and parts affected with *erysipelas* and *rheumatism*, either suitably medicated or alone, and is much used as a dressing in various surgical affections, and after operations. Deprived of oily matters by boiling with an alkali, it is known as *absorbent cotton*, and when thus prepared should take up about fifteen times its weight of water. By exposure to high dry heat it may be rendered free of disease-germs, and then it forms the *antiseptic cotton* of modern surgery. *Impregnated with iodoform*, cotton may be packed in the vagina as a tampon, in various *uterine hemorrhages* (as in threatened *abortion*, etc.), or to give support and correct displacement in cases of *version of the uterus*. It is particularly adapted to those cases where, from inflammation or tenderness of parts, an ordinary pessary could not be worn. It is also *impregnated with carbolic*, *salicylic*, *boric acid*, or *corrosive sublimate*, for use as a surgical dressing.

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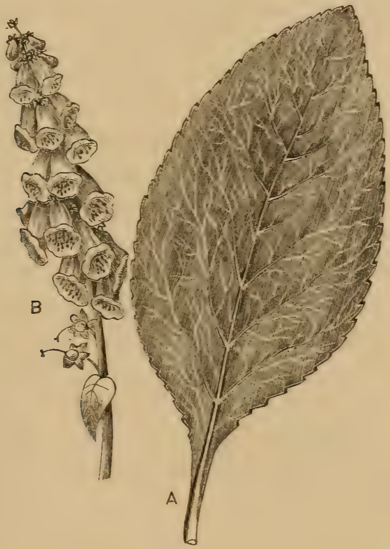
* "Gossypium Herbaceum." Thesis by Thos. Harry Huzza, M.D., awarded the *Medical News* prize at the Jefferson Medical College, of Philadelphia, 1887.

DIGITALIS.

Digitalis purpurea, or Purple Foxglove (*Nat. Ord.* Scrophulariaceæ), is a biennial European plant, cultivated in our gardens, with an erect stem three or four feet high, large ovate-lanceolate, crenate, downy and veiny leaves, of a dull green color, and handsome bell-shaped crimson or purple flowers, arranged in a large terminal spike. The seeds and LEAVES are both active, but the latter only are employed, *from plants of the second year's growth;* and those from the European wild plants are preferred, as the cultivated variety is thought to be inferior in virtue. The English digitalis-leaves are superior to the German because they are carefully selected and freed from the stalks, which do not represent the activity of the plant. The petioles are removed, and the leaves are then dried in baskets, in a dark place, in a drying-stove. When dried, they have a dull-green color, with a faint odor and a bitter, nauseous taste, and afford a fine deep-green powder. Both leaves and powder should be preserved in well-stoppered bottles covered externally with dark-colored paper, and kept in a

FIG. 23.



DIGITALIS PURPUREA, A. LEAF; B. FLOWERS.

dark cupboard, and, as their medicinal activity is impaired by keeping, they should be renewed annually.

CHEMICAL CONSTITUENTS.—The leaves contain numerous so-called principles, among which are *digitalin*, *digitoxin*, *digitonin*, and *digitalein:* many of these are the result of decomposition, either during plant-life, or during the treatment of the extract or exhaustion of the plant. They are all glucosides except digitoxin. By digitalin is meant the product obtained by Schmiedeberg in 1874. The digitalis-principles may be arranged according to their solubility; viz., those soluble in alcohol and almost insoluble in water (digitalin and digitoxin); and those miscible both in alcohol and water (digitonin and digitalein). Consequently such preparations as the tincture and fluid extract contain the most digitalin and digitoxin; the infusion, digitonin and digitalein. *Digitonin* is said to resemble saponin, but differs from it in its behavior to chemical reagents. The other constituents are *inosit*, *pectin*, *resin*, the *digitalic acids*, and *fixed oil* (about 5 per cent.). Digitalin and digitoxin are the most active ingredients of the plant.

Digitalin, when perfectly pure, occurs as fine, white, glittering hygroscopic needles, or groups of crystalline tufts, odorless, but of a very bitter taste; readily soluble in alcohol, chloroform and warm acetic acid, but nearly insoluble in water and ether; dose, from $\frac{1}{60}$ to $\frac{1}{30}$ of a grain. A dose above gr. $\frac{1}{15}$ causes purging and vomiting.

TESTS.—Chemical analysis affords no certain tests of the presence of digitalis or its active principle, even Grandeau's method of isolating digitalin by dialysis being uncertain, and in cases of suspected poisoning the *physiological* test must be resorted to. This, however, is not proof positive of its presence, for Fagge and Stevenson * have shown that digitalis is only one of a small class of substances (as helleborus viridis and scilla) the action of which on the frog's heart appears to be identical. These they termed cardiac poisons. In every experiment they caused cardiac irregularity, followed by stoppage of its pulsations in *rigid ventricular contraction.* In the celebrated *Pommerais* case, the criminal was condemned from the evidence derived from the administration of an extract obtained from the stomach and bowels of the deceased party, to small animals, in whom were produced vomiting and marked diminution of the number of heart-beats, with intermittent and irregular action.

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* Proc. Royal Society, XIV, p. 270. On the application of Physiological Tests for Certain Organic Poisons, especially Digitaline.

Incompatibles.—Forms an inky mixture with ferric chloride and sulphate; with compound tincture of cinchona and tannin a precipitate goes down; lead subacetate and acetate produce a copious precipitate. The precipitation with the iron and lead salts is due to combination with the digitalis-acids.

Aids.—Upon the heart and vessels, adonidin, strophanthus, sparteine, cimicifuga, and ergot.

Physiological Effects.—Though the action of digitalis is directed chiefly to the circulatory apparatus, yet in lethal quantity other phenomena are induced, as follows. Nervous system: in toxic doses, digitalis lowers reflex activity by exciting Setschenow's inhibitory reflex centre, and, after a time, paralyzing the spinal cord (A. Weil), causing prostration, muscular tremors and sometimes convulsions. Circulation: its action here has been investigated by Vulpian, Pélikan, Homolle,* Gaskell † and others, with the following results, viz.: that it lessens the number of cardiac pulsations, *prolonging the diastole*, *energizing the systole*, and finally paralyzing the heart *in systole;* this is produced by direct stimulation ‡ of the cardiac muscle, and possibly of the contained motor-ganglia, as well of the peripheral inhibitory fibres of the pneumogastric. Moderate doses cause a rise in the arterial pressure, probably by contracting the arterioles, through stimulation of the vaso-motor centres of the cord; after large doses the pulse becomes dicrotic from irregular ventricular contraction; toxic doses, or, when the heart is much depressed, a sudden change from the recumbent to the erect position, may cause a frequent, weak and small pulse, with lowered blood-pressure. An entirely satisfactory explanation of the *modus operandi* of digitalis on the circulatory apparatus has not so far been made. The influence of digitalis over the pulse is more marked in weak and debilitated persons, than in those who are robust and plethoric. Its effects, too, in this particular are more easily obtained in the recumbent than in the erect posture, owing to the less force required in the former position to carry on the circulation. In the repeated use of small doses of this medicine, a *cumulative effect* is sometimes observed: its powers are not manifested for a certain time, and effects are suddenly produced, which are attributable to the whole amount administered, acting together, by failure of excretion, giving rise to dangerous and even fatal syncope. In morbid conditions of the circulation, where it is irritable, abnormally quick or irregular, digitalis is considered to exercise a primary medicinal effect in *steadying* the pulse and restoring its force and regularity, while it diminishes morbid frequency. Where the temperature of the body is abnormally increased, digitalis, in large doses, will diminish it. From its action on unstriated muscular fibres, digitalis has the property of stimulating the uterus to contraction. As regards its *diuretic action*, it is probably rather indirect than direct, and is most conspicuous where dropsical effusions are removed under its influence. Brunton has, however, shown that in dropsies it acts directly on the Malpighian tufts, independently of the blood-pressure; also, that when taken for a long time, and accumulating in the blood, it diminishes the urinary flow by contraction of the renal vessels. It increases the amount of solids eliminated in the urine, except that of urea and uric acid, which are diminished under its use. In health, the action of digitalis upon the quantity of urine is uncertain.

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* *Arch. Gén. de Médecine*, XVIII, p. 5. Exper. physiol. sur quelques preparat. de digitale.

† *The Journ. of Physiology*, III, p. 48. On the Tonicity of the Heart and Blood Vessels.

‡ Proc. of the Royal Med. and Surg. Soc., I, 1882–5. Investigations into the Action of the Digitalis Group. Ringer and Sainsbury.

TOXICOLOGY.—When too long continued, or taken in *excessive doses*, digitalis acts as an acro-narcotic poison, producing vomiting, purging, irregular, feeble and rapid cardiac action, severe abdominal pains, vertigo, disordered vision, dilated pupils, syncope, and finally delirium and stupor, death being usually preceded by convulsions. The quantity of digitalis, however, that may be given, especially in disease, without destroying life, is considerable. According to Woodman and Tidy about gr. ¼ of digitalin would prove fatal, and a toxic amount rarely kills in less than 24 hours.

ANTIDOTES.—In such cases, after evacuating the stomach, the diffusible stimuli, as brandy and ammonium carbonate, should be administered. Opium, aconite, etc., antagonize to some extent the action of digitalis; the most complete antagonism exists between digitalis and saponin, the active principle of Saponaria officinalis (Köhler).

MEDICINAL USES.—From its action on the circulation, digitalis has been used in adynamic *fevers* and *inflammations*, and in hemorrhages, especially that of *menorrhagia*, and in *post-partum hemor-*

rhages. In *hectic fever*, it is often combined with quinine, and if it do not disorder the digestion, it is generally of great value: ℞ Quininæ sulphatis, gr. xxiv; pulveris digitalis, gr. viij; pulveris opii, gr. vj. M. et ft. pil. xxiv. Sig.—Take one pill 3 or 4 times a day. In fevers accompanied by a high temperature, as *scarlatina* and *typhoid fever*, it is specially useful. In the treatment of diseases of the heart and great vessels, it is a remedy of the greatest value, but it is to be prescribed with discrimination. In *dilatation of the heart*, in *fatty degeneration*, and in *irritability of heart-action* generally, digitalis, by increasing the force of the cardiac contractions and by abating irregular movement, is always useful; in uncomplicated *hypertrophy* it is objectionable. In *valvular regurgitation*, *aortic* or *mitral*, if the heart's action be feeble its administration is called for, particularly if accompanied by dyspnœa and dropsy, and when so indicated it should be given in doses large enough to produce its physiological effect, viz., to increase the force but reduce the number of pulsations, to raise the arterial tension, and augment the urinary flow. At the same time the bowels must be kept freely opened with the hydragogues, and sufficient rest in the recumbent position enjoined as the case may seem to require. In cases of sudden *syncope* from any cause, a hypodermic injection of the tincture ♏x–xx, repeated, if necessary, in half an hour, may be advantageously administered. H. C. Wood states that he has never seen any severe local irritation follow this use of the tincture, which also accords with the observations of others in several cases. In *aortic constriction*, if the heart's action be feeble, it is indicated.

It is greatly esteemed in the treatment of *ascites* and *dropsy;* and in the varieties of this disorder resulting from heart-disease the infusion of digitalis is more employed than any other remedy, from its combined cardiac and diuretic influence. In these conditions it may often be advantageously combined with iron. ℞ Pulveris digitalis, gr. xv; ferri sulphatis exsiccati, gr. x; quininæ sulphatis, gr. xx; oleoresinæ capsici, gr. iij. M. et ft. pil. xx. Sig.—Take one pill three times a day; or the infusion may be alternated with a mixture containing tincture of ferric chloride. It is a valuable remedy in *acute Bright's disease*, especially when dropsy is present, and also in *chronic Bright's disease* of the kidney under like circumstances. In *delirium tremens* digitalis has been given in large doses, with excellent effect, and it occasionally proves efficient as a heart tonic in that obstinate condition known as *exophthalmic goitre.*

Administration.—Digitalis may be given in powder, of which the dose is gr. j two or three times a day, to be gradually increased. The official preparations are the *abstract*, dose, gr. ss–j; the *infusion** (powdered digitalis and cinnamon each 3 parts, macerated in 185 parts of boiling water for 2 hours, then strained and 15 parts of alcohol passed through the strainer, and water enough to make 200 parts), dose, fʒij–iv; the *tincture*, dose, ♏v–fʒj; the *extract* (alcoholic), dose, gr. ¼, gradually increased; the *fluid extract*, dose, ♏j to begin with. If digitalis produce wakefulness, a little opium may be combined with it.

ADONIDIN.

Adonidin (not official) is a glucoside, obtained from the root of Adonis vernalis (*Nat. Ord.* Ranunculaceæ), a plant of central Europe. It was first isolated by Cervello,† and is an amorphous substance, odorless, colorless, but having an intensely bitter taste, soluble in alcohol, but slightly soluble in ether and water.‡

Aids.—See digitalis.

Effects and Uses.—Adonidin is *almost identical in action* with digitalis,§ strengthening the cardiac energy, while diminishing its frequency by prolonging the diastole, thus allowing the engorged veins time to empty themselves, and at the same time raising the arterial tension by contracting the arterioles. It acts more quickly on the heart than digitalis, and is not so apt to disorder the stomach and bowels (Cervello, Durand), although these effects are sometimes observed.

According to most authorities it possesses considerable diuretic powers, increasing both the water and the solids of the urine.

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* The following formula for infusion of digitalis is proposed by J. W. England, Ph.G. (*Am. Journ. Pharm.*, July, 1892): Take of digitalis leaves, bruised, gr. 120; water, f℥ 14½; ammonia water, ♏90; alcohol, f℥ j. Macerate for an hour, agitating well occasionally, filter, express residue, wash with water, and filter, to make f℥ 14½. Now add ♏90 of ammonia water, alcohol f℥ i, and sufficient water to make the volume measure one pint. The ammonia water is added to prevent decomposition; and cold-water maceration employed because it dissolves more of the active and less of the coloring principles.

† *Archiv für Experiment. Pathol. und Pharmakol.*, 1882, p. 338.

‡ "Poisons; their Effects and Detection," by Alexander Wynter Blyth. Am. Ed. p. 396.

§ V. Cervello, *op. cit.* and *La Méd. Contemp.*, July and Aug. 1885. E. Durand, *Journ. de Méd.*, Dec., 1885, and *Thèse de Paris*, 1886. Bubnow, *Centralbl. für die gesammte Therapie*, 1885. Houchard, *Gaz. Hebdomadaire*, Jan. 1st, 1886.

It is rapidly eliminated, and has no cumulative action (Cervello). According to Hare,* in all doses it heightens the arterial tension by stimulating the vaso-motor centres and increasing the force of the cardiac contractions; large doses slow the heart by stimulating the vagus, which finally becomes paralyzed, the pulse rate being then accelerated.

Adonidin may be used for the same purpose as digitalis, particularly *mitral regurgitation*, to which, however, it is inferior. When the latter is contraindicated from some idiosyncrasy on the part of the patient, or when it disorders the stomach, or if its action be not sufficiently rapid, adonidin may be substituted with advantage. It may, too, be alternated with digitalis, giving either for a few weeks at a time. Dose, gr. ⅛–½ in compressed pill or capsule.

STROPHANTHUS.

Strophanthus (not official) is the seed of the Strophanthus hispidus (*Nat. Ord.* Apocynaceæ), a plant distributed along the coast of Africa, between Senegambia and Lower Guinea. It is described by Blondel† as a branchy bush growing to the height of three or four metres, which gives off yellowish-white flowers, appearing in April or May, arranged in terminal cymes. The seed is contained in a thin cylindrical pod, the length of which varies between 25 and 50 centimeters. They are from 10 to 14 millimetres in length and consist of a tiny tuft supported on a slender stalk These seeds, coarsely powdered and made into a paste, are used by the natives to poison their arrows, and are called Combé, Kombé, or Ineé. From strophanthus Dr. Thomas B. Fraser‡ has isolated a crystalline glucoside, which he calls *strophanthin* ($C_{31}H_{48}O_{12}$), and to which the effects of the seed are due. It is non-nitrogenous; of a strongly-bitter taste and feebly-acid reaction, and is freely soluble in water, in rectified spirits, but not in ether.

AIDS.—Digitalis, adonidin, and sparteine.

EFFECTS AND USES.—Pélikan in 1865 called attention to strophanthus as a powerful cardiac poison, and his researches were confirmed by Fraser,§ Corville,‖ and others. When introduced into the system it increases the strength of the cardiac systole, while prolonging the diastole, and in over-doses arrests the heart in rigid systolic contraction. It is a muscle-poison, increasing the contracting power of all the striated muscles, and rendering their contractions more complete and prolonged, but the heart is easier influenced by it than are other muscles, and the dose may be so regulated that the cardiac effects are alone produced. It also contracts the arterioles somewhat, but not to the same extent as does digitalis. It produces a slight lowering of temperature and is a diuretic.* It rarely causes vomiting, and has no cumulative action.

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* *Therap. Gaz.*, Apr. 15th, 1886.

† *Bull. Gén. de Thérap.*, Février, 1888, p. 97.

‡ *Brit. Med. Journ.*, Nov. 14th, 1885.

§ *Op. cit.*; also Proc. Royal Soc., 1879; *Journ. Anat. and Phys.*, 1872; *Brit. Med. Journ.*, Jan. 22d, 1887, and a monograph by Fraser "on the action of the digitalis group," containing a reprint of foregoing articles.

‖ *Med. Digest*, Sec. 393; 1, 1872.

Strophanthus, or strophanthin has been used as a substitute for digitalis, as in *mitral regurgitation*, when the latter disagrees, or was objectionable from its effect in contracting the arterioles and thus throwing more work on an already overtaxed heart.

A tincture (1 to 20 parts in weight) is recommended by Prof. Fraser, of which the dose is ♏j-xx, t. d.

Of strophanthin, gr. $\frac{1}{100}$–$\frac{1}{60}$ may be given *hypodermically*.

SPARTEINE.

Sparteine ($C_{15}H_{26}N_2$) is an alkaloid obtained from Sarothamnus Scoparius, or Broom (*Nat. Ord.* Leguminosæ), and occurs as a strongly alkaline, dense oily liquid, but slightly soluble in water, readily soluble in alcohol, ether and chloroform, having an intensely bitter taste and an aniline-like odor. It combines readily with acids to form salts, which are preferred for medicinal use because they are more readily soluble.

AIDS.—Digitalis, strophanthus, and adonidin.

PHYSIOLOGICAL EFFECTS.—Like the other members of the digitalis group, sparteine is a *cardiac tonic*, acting through the central nervous system, *increasing* the *intensity* and *persistence* of the *ventricular contractions* and regulating the cardiac rhythm.†

In large doses it completely paralyzes the motor-nerves and diminishes reflex action (Fick). It does not appear to affect muscular contractility. Sparteine is probably not the diuretic principle of Scoparius, and according to most observers has no effect on the urine, although Fick asserts that it increases diuresis. It does not disorder the stomach, has no cumulative action, and acts on the heart more promptly than digitalis (Sée). In overdoses it is capable of causing a fatal result, death being due to paralysis of the respiratory centre, and preceded by a stage of excitement, quickly followed by collapse. Poisoning from sparteine should be treated by artificial respiration and electricity applied over the vagi; and if it has been taken by the mouth in the form of sulphate, potassic iodide in aqueous solution should be administered, as in the presence of water this seems to form an almost insoluble salt (Dandrieu), and in any event elimination should be favored by diuretics and diluents.

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* *Bull. Gén. de Thérap.*, Août 23d, 1888, Lemoine. *Ibid.* t. 116, p. 69, 1889, *Égasse.*

† *Archiv für Experiment. Pathol. und Pharmakol.*, Fick. Band 1, p. 397. *Thèse*, Montpellier, 1887; "La Sparteine et ses Sels,' par P. Dandrieu. *Gaz. Hebdom.*, Nov. 27th, 1885, Germain Sèe, et al.

MEDICINAL USES.—It has been used with success in cases of *weak, feeble* and *irregular heart,* particularly when the cardiac rhythm is disturbed. It is *employed* as a substitute for digitalis in *mitral regurgitation,* in *cardiac dropsy* and in *cardiac dyspnœa,* but that it can fully replace digitalis in the treatment of heart-affections is yet not fully established. As its action is more rapid than digitalis, it may be prescribed when prompt results are required, and thus gain the time necessary for the influence of the digitalis to manifest itself.

The sulphate is the salt usually preferred and may be given in doses of gr. ss-ij, t. d., in pill, capsule or solution. It is also used hypodermically.

CIMICIFUGA.

Cimicifuga racemosa, Black Snakeroot, or Cohosh (*Nat. Ord.* Ranunculaceæ), is a very common indigenous perennial plant, growing to the height of from four to eight feet, with ternate leaves, oblong-ovate, incised and toothed leaflets, and small white flowers disposed in a long raceme. The RHIZOME and ROOTLETS are the parts employed. The rhizome is a rugged, blackish-brown caudex, from a third of an inch to an inch in thickness, often several inches in length, furnished with numerous slender rootlets. Internally its color is whitish; it has a peculiar faint, disagreeable odor and a bitter, somewhat astringent, taste. It imparts its virtues to boiling water, and contains *gum, starch,* two *resins, tannic,* and *gallic acids,* and a *volatile oil.* The active principle has not yet been isolated, nor has a crystalline proximate substance been found.*

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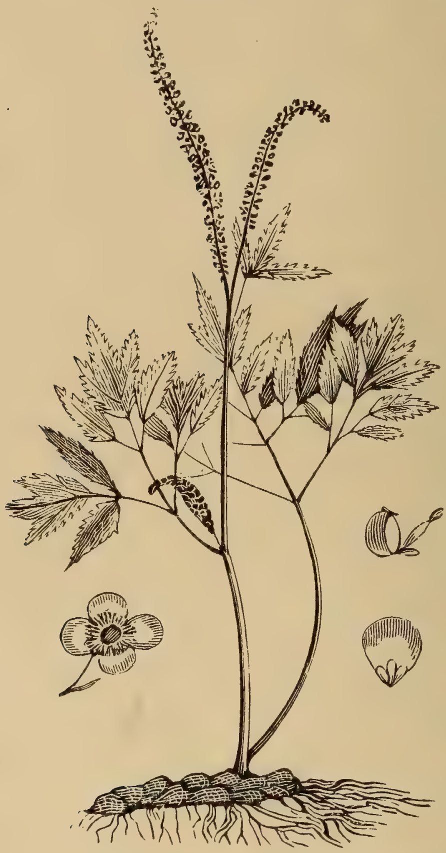
* "Lloyd's Drugs and Med. of North America," Vol. 1, p. 266.

Incompatibles.—As it contains tannic and gallic acids (q. v.), precipitates are formed with ferric salts.

Aids.—Digitalis, strophanthus, and sparteine enhance its cardiac action; ergot upon the uterus.

Effects and Uses.—The effects of cimicifuga are not very accurately known. After large doses, vertigo, dilated pupil, and often hypnotic and anodyne effects are seen. On the circulation its effects are similar to, but less powerful than, those of digitalis, as it slows the cardiac beat, while increasing the strength of its contraction, and raising the arterial tension. It is undoubtedly an active stimulant of the secretions, particularly those of the skin, mucous

FIG. 24.



CIMICIFUGA RACEMOSA.

membranes and kidneys. It acts also on the uterus and unstriped muscles like ergot, but less powerfully. It increases the sexual appetite of the male and promotes the menstrual flow of the female. It has been *prescribed* with advantage as an expectorant in *chronic bronchitis*, and occasionally in caseous *pneumonia* and *phthisis*. In *fatty heart* it is safer than digitalis, and may be used in *dilated heart*, with languid circulation and oppressed breathing. It has also been used as a diaphoretic in *rheumatism* and as a diuretic in *dropsies*. As an antispasmodic in *chorea* it enjoys some reputation. In the relief of *after-pains*, and in *menorrhagia* it is frequently of service, and it is a good remedy in *subinvolution of the uterus*.

ADMINISTRATION.—Dose, in powder, gr. xx-ʒj. Of the *fluid extract* or *tincture* the dose is fʒss-j or ij.

DEPRESSO-MOTORS.

CONIUM.

Conium maculatum, or Hemlock (*Nat. Ord.* Umbelliferæ), is a biennial European plant, naturalized in many parts of the United States. Its stem is erect, from three to five feet high. The leaves are large and bright green; the flowers are small, white, and arranged in umbels. The whole plant is narcotic and virulent, and has a fetid, heavy odor. The FULL-GROWN FRUIT (gathered while yet green, and carefully dried) is the only portion used. It has a yellowish-gray color; a feeble odor and a bitterish taste; it is roundish ovate, a line and a half in length by a line in breadth, and striated.

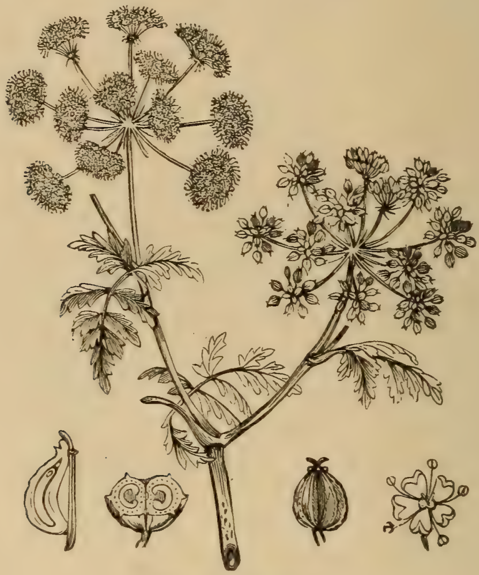
CHEMICAL CONSTITUENTS AND TESTS.—The active principle of hemlock is an alkaloid termed *conine* ($C_8H_{15}N$), which exists in larger proportion in the seed than in the leaves. It is a colorless, transparent, volatile, oily fluid, of a peculiar repulsive, suffocating, mouse-like odor and a bitterish taste, sparingly soluble in water, and freely so in alcohol, ether and chloroform, and undergoes decomposition upon exposure to the air. It is a highly energetic poison, even in very small quantity; the dose of it is gr. $\frac{1}{16}$. Other alkaloids, termed *conhydrine* ($C_8H_{17}NO$) and *methylconine* ($C_8H_{14}CH_3N$), have been isolated; all probably exist as *malates*. Conine combines with acids to form salts, and unites with water as a hydrate. *Tests.*—Sulphuric acid turns conine to purplish-red changing to green; with perchloride of gold a yellowish-white precipitate is formed.

INCOMPATIBLES.—Solutions of the alkalies liberate the alkaloid from its salts with the odor of hemlock. Tannic acid precipitates the alkaloid.

AIDS.—Depresso-motors as woorara, physostigma, tobacco and gelsemium.

PHYSIOLOGICAL EFFECTS.—The following account is based on the investigations of Lautenbach* (chiefly), and Hubert-Valleroux.† *Local* action: conine applied to a part produces paralysis of the end-organs of the sensory nerves with which it is brought in contact, and consequently numbness or loss of sensation. Nervous system: hemlock has but little influence upon the cerebral hemispheres, for in cases of poisoning from it, consciousness has been preserved to the last. A full medicinal dose induces the following effects: a sense of muscular fatigue and feebleness of the legs is felt, the eyelids droop, and vision becomes impaired, accompanied by dilatation of the pupil. In lethal doses conium causes paralysis, which is due to a paralyzing influence on the terminal extremities of the motor-

FIG. 25.



CONIUM MACULATUM.

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* *Trans.* Acad. Nat. Sci., Phila., 1875, p. 367; The Phys. action of hemlock and its alkaloid.

† *Arch. Gén. de Médecine* 6e ser. t. xvi, p. 83. De la ciguë at son action phys. et thérap.

nerves. It impairs the conductivity of the sensory nerves, while its action on the cord is one of progressive depression (Lautenbach). The circulation is at first accelerated, then retarded, but further investigation is here required. The arterial pressure is at first lowered, and then decidedly raised; the respiratory movements are not altered unless a poisonous dose has been taken, when the respiratory centre is paralyzed and death ensues from asphyxia. Temperature: some lowering of the animal heat has been noted; but this, lately, has been denied by Lautenbach. Secretions: conium has no action on the glandular organs, except the salivary glands, the discharge from which it increases. Elimination: hemlock is eliminated in part by the urine, as it has been found there. Orfila detected it in the spleen, kidneys, and lungs. It has no direct *hypnotic* effect. Like woorara, its *characteristic physiological effect* is the *production* of pure *motor paralysis*, beginning in the extremities and extending to the trunk, involving chiefly the terminal nerve-endings.

TOXICOLOGY AND ANTIDOTES.—In large doses it causes nausea, vertigo, dimness of vision, relaxation of the muscles; and in poisonous quantities, dilatation of the pupils, difficulty of speech, delirium or coma, paralysis, and finally convulsions (of cerebral origin) and death. In cases of poisoning, the stomach must be evacuated, and as physiological antidotes, the tetanizing agents, as *strychnine* and picrotoxin given, and alcoholic stimuli if necessary.

MEDICINAL USES.—It is employed as a general and *topical anodyne*, to relieve the pain of malignant *tumors;* and, even if destitute of the deobstruent powers which have been ascribed to it, it certainly exerts a remarkably palliative influence upon painful chronic indurations. It has also been prescribed as an antispasmodic in *whooping-cough*, *asthma*, as a motor-depressant in *paralysis agitans*, *chorea* and *acute mania*, and as an anodyne in *neuralgia;* as an adjuvant to other remedies in *melancholia;* to moderate irritability of the sexual organs; to relieve the blepharospasm of many acute inflammations of the eye; and it is used externally as an anodyne-cataplasm to cancerous and irritable *ulcers*. Conium is quickly absorbed, and is eliminated with equal rapidity; hence its effects are speedily induced, and are of brief duration. It is the *cicuta* of Hippocrates, Galen, and Pliny, and is supposed to have been the poison administered to Socrates and Phocion.

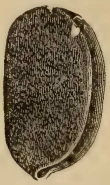
ADMINISTRATION.—The dose of the powder, gr. ss-j. The *extract* (*alcoholic*) may be given in the same doses. An *abstract* is also official; dose, gr. ¼-j. A *tincture* (dose f℥ss-j) and a *fluid extract* are also used; of the *fluid extract*, in preparing which hydrochloric acid is employed to fix the alkaloid *conine*, the dose is ♏iv-v, gradually increased until some effect is obtained.

The preparations of conium are uncertain, from the fact that the active principle is very volatile and easily escapes. Probably the best preparation is the fluid extract.

PHYSOSTIGMA.

Physostigma or Calabar Bean is the SEED of Physostigma venenosum (*Nat. Ord.* Leguminosæ), a perennial climbing plant of the western coast of Africa. The seed is about the size of a large horse-bean, irregularly kidney-form in shape, with a hard, brittle integument, and of a dark chocolate-brown color. The inner kernel is by far the more active portion. Alcohol, but not water, extracts its medicinal virtues. The Calabar bean has long been used among the negroes of western Africa as an ordeal to determine the guilt or innocence of accused individuals, whence its name, the *ordeal bean of Calabar*.

FIG. 26.



CALABAR BEAN.

CHEMICAL CONSTITUENTS.—It yields an active alkaloid, termed *eserine* or *physostigmine* ($C_{15}H_{21}N_3O_2$) sparingly soluble in water, but more soluble in alcohol, ether, and chloroform; and recently another alkaloid, termed *calabarine*, which is believed to be a tetanizing agent, has been found in it in variable amount.

INCOMPATIBLES.—The alkalies and tannic acid.

AIDS.—The motor-depressants, as conium, gelsemium, woorara, tobacco, etc.

PHYSIOLOGICAL EFFECTS.—The *local* application of a strong solution abolishes the functions of both kinds of nerves (Fraser).*

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* For an elaborate account of the action of Calabar bean, consult Dr. T. R. Fraser's Thesis, 1863.

It has been found, in full medicinal doses, to produce giddiness, torpor, paleness and coolness of the surface, weak and irregular pulse, relaxation of the muscular system, and drowsiness, but not stupor. An interesting effect of its action is a remarkable power of contracting the pupil, whether taken internally or applied externally: it seems probable that this is accomplished by a local peripheral action—*i. e.*, paralysis of the sympathetic terminals and stimulation of the oculo-motor fibres in the iris; and it also contracts the ciliary muscle, which regulates the accommodating power of the eye.

Nervous system: the brain is not directly affected by Calabar bean, the paralysis induced by it being due to a depressing action upon the spinal cord. In proof of this statement can be offered the fact that the muscular contractility and irritability of the motor and sensibility of the sensory nerves remains unimpaired in cases of poisoning by physostigma. Lethal doses of physostigma cause total loss of reflex activity in the cord. Circulation: small doses of physostigma retard the heart's action by lengthening the diastolic pause, while toxic doses arrest it in diastole, but before the movements are extinguished there is a marked fall in blood-pressure. The stoppage is probably due to paralysis of the cardiac ganglia. Respiration: toxic doses of physostigma cause slowing of these movements, and eventually they are abolished, death ensuing from asphyxia. It is allied in its effects to woorara and conium, but differs from them in its tendency to produce muscular twitchings and contraction of the pupil. Intestines: Calabar bean increases decidedly intestinal peristalsis. Augmentation of the salivary secretion has been observed.

Toxicology and Antidotes.—A poisonous dose of physostigma in man causes nausea, giddiness, muscular weakness and tremors, diminished cardiac action, abolition of reflex action, slow respiration, myosis and motor-paralysis. In cases of poisoning, after emptying the stomach, the hypodermic administration of a solution of *atropine* is the best physiological antidote. Chloral mitigates the symptoms, and the tetanizers may render service.

Medicinal Uses.—Calabar bean has been found highly efficacious, from its power of reducing and abolishing the reflex activity of the cord, in traumatic *tetanus*, but it must be given in doses large enough to attain decided effects. Fraser advises the exhibition of eserine hypodermically in severe cases. It has been used also with success as a motor-depressant in *paralysis agitans* and in *chorea;* likewise in poisoning from strychnine. In ophthalmic surgery its employment is obvious, either to produce contraction of the pupil or to increase the power of accommodating the eye to distances.

ADMINISTRATION.—The dose of the kernel is laid down as gr. ij–iij, to begin with, gradually increased. By exhausting the kernel with alcohol, and subsequent evaporation, an *extract* is obtained, of which the dose is gr. $\frac{1}{8}$. A good form of exhibition is the *tincture* (100 parts contain 10 parts of powder), dose, ℳv–xv; or a solution in glycerin may be used. *Eserine* itself, or as a salt, one part to a thousand in solution, may be applied to the eye in ophthalmic practice, as to contract the pupil in *photophobia*, to lessen intraocular tension early in *glaucoma* and in *keratitis;* dose, internally, gr. $\frac{1}{60}$–$\frac{1}{12}$. *Physostigminæ salicylas* is official. It is the most stable salt of the alkaloid, but its slight solubility in water renders it of little value for hypodermic injection. Dose, gr. $\frac{1}{65}$–$\frac{1}{12}$ (Stillé and Maisch). Gelatin-disks are now much used by oculists.

CHLORAL.

This interesting compound, although discovered by Liebig in 1832, has attracted attention as a therapeutic agent only since the statements of Liebreich, a physician of Prussia, published in May, 1869.

PREPARATION.—It is prepared by passing dried chlorine gas through pure anhydrous alcohol, afterward gently heating, when the liquid separates into two layers, the lower of which is chloral; this is agitated with sulphuric acid, and purified by distillation, first over sulphuric acid and then over quicklime; the reaction, upon which the formation of chloral depends, in this process, is complicated, chloral and hydrochloric acids being the chief products. Anhydrous chloral (C_2HCl_3O) is a thin, limpid, oily, colorless liquid, greasy to the touch, with a fatty taste, and a strong pungent smell, producing lachrymation. Chemically, it is classed with the halogen aldehydes. It has a sp. gr. of 1.502, a boiling point of 203° F., and mixes in all proportions with water, alcohol, ether and chloroform.

CHEMISTRY AND TESTS.—Mixed with one-eighth its weight of distilled water, it combines to form the so-called hydrate ($C_2HCl_3O.H_2O$), for it contains an entire molecule of water, which crystallizes in a mass of snow-white needles, soluble in their own weight of water; and, as pure chloral readily undergoes decomposition, the more stable hydrate is the form which is employed for medicinal use. *Tests.*—Pure chloral hydrate[*] when pressed between blotting-paper does not leave oily spots; its taste is bitter and somewhat astringent; makes a neutral solution with water without forming oily drops; is not decomposed by the action of the atmosphere; dissolves readily in water, ether, and alcohol; the aqueous solution acidulated with HNO_3 affords no evidence of chlorine when treated with $AgNO_3$. The chloroformic solution yields no change of color when agitated with H_2SO_4.

Chloral combines also with alcohol, forming a compound termed *Chloral Alcoholate*, which resembles the hydrate, but is less soluble in water, and is said by Liebreich to be therapeutically inert.

INCOMPATIBLES.—The volatile and fixed alkalies, and calcic hydrate, convert chloral into formate of the metal and chloroform.

AIDS.—Morphia, the bromides, and sleep-producing agents enhance its hypnotic effects; upon the spinal cord, conium, physostigma, woorara, etc.

PHYSIOLOGICAL EFFECTS.—Chloral has decided antiseptic properties, destroying low organisms and preventing the decomposition which they induce, as pointed out by Keen;[†] and it is also an irritant. Its taste is bitter, astringent and somewhat caustic. Nervous system: in doses of 20 grains, chloral is a most reliable hypnotic, the sleep being usually, quiet, natural, and refreshing.[‡] Generally, no unpleasant effects follow its employment, though occasionally headache and slight nausea supervene. According to Hammond, chloral causes cerebral anemia, the brain being in this condition when chloral-sleep sets in. In medicinal doses, it is not a pain-relieving agent in the way that opium is. In hypnotic doses it slightly contracts the pupil.

Da Costa[§] states that it has no special action on the secretions, except some augmentation of the urine, and is probably eliminated by the kidneys. When larger amounts are given, the sleep is deeper, and may pass into coma; the respiration is slower;

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[*] Attfield's "Chemistry," 10th ed., p. 444.

[†] *Amer. Jour. Med. Sci.*, July, 1875.

[‡] *Bull. Gén. de Thérap.*, LXXVII, p. 307, Demarquay.

[§] *Am. Jour. Med. Sci.*, April, 1870, p. 309. Clinical notes on chloral.

the pulse is reduced in fullness and frequency, the arterial tension being lowered; the temperature falls; the muscular system is relaxed; and both sensibility and *reflex action are abolished,* the latter being brought about by a direct action on the spinal cord, since chloral does not affect the motor-nerves nor muscular contractility. Ringer * found that it affected the cardiac tissues directly and ultimately stopped the heart in diastole, the contractility of the muscle-substance being extinguished by it, though Brunton states it paralyzes the cardiac ganglia. It was formerly asserted that chloral is decomposed in the blood by the liberation of chloroform; but this is not the case, as Amory† has proved, for no chloroform could be detected in the breath or blood of a dog poisoned by chloral, but on introducing chloroform by enemas this drug was found in the blood and respired air at once.

TOXICOLOGY.—Large amounts may be taken without fatal results, as 460 grains have been given without unpleasant effects, though gr. xx, in three cases, proved poisonous, and gr. xxx killed an adult female.‡ The symptoms of poisoning are profound sleep, diminished frequency of the respiration and circulation, redness of the conjunctivæ, contraction of the pupils, lividity of the lips, and falling of the jaw, with occasionl eruptions of the skin. Death takes place probably from sudden failure of the heart's action, which stops in diastole, or from paralysis of the respiratory centre.

ANTIDOTES.—The treatment of chloral-poisoning is much the same as that pursued in opium-poisoning; artificial respiration should always be resorted to before the respirations cease. Strychnine has been recommended to prevent cardiac failure, but according to Dr. Kobert, while chloral is the best antidote for poisoning by strychnine, their antagonism is not reciprocal, as the latter neither prevents the respiratory arrest, nor counteracts the depressing effect of chloral on the heart, nor prevents the lowering of the bodily heat. *Atropine* is probably the best antidote in cases of chloral-poisoning; it should be given frequently, guided by the respiration, and the temperature of the body should be maintained by the application of dry heat.

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* *Brit. Med. Jour.,* March 10th, 1883. Experimental investigation on the action of chloral, etc.

† *N. Y. Med. Journ.,* XV, 1872, 606; also *Journal de l' Anatomie et de la Physiologie,* 1870–71, p. 570.

‡ *The Lancet,* March 25th, 1871, 403.

MEDICINAL USES.—Chloral is a most valuable *hypnotic* remedy in all the forms of *insomnia*, in *hysterical excitement*, in *acute mania*, *mania à potu*, and in *delirium tremens*. As an antispasmodic, large doses are required. It has been used with advantage in *infantile convulsions*, and even in *puerperal* and *uremic convulsions*, both by the mouth and hypodermically, and it is especially recommended in the relief of rigid os during *labor*. In *sea-sickness* it is highly recommended, though nothing is of much service in this complaint. In *tetanus*, in order to lessen the spinal reflex activity, much success has been obtained with chloral, in ten-grain doses every two hours; and the same remedy may be given to alleviate the paroxysms of spasm of *hydrophobia*. In *whooping-cough* and *chorea*, it has also been employed with advantage, and as an antidote against strychnine. As an anodyne it is available, but only in narcotic amounts. The ordinary dose of chloral is 20 grains, which may be safely repeated every hour or two, till three doses have been taken or sleep occurs. An equal weight of chloral hydrate added to powdered camphor makes a valuable local anæsthetic liquid.

ADMINISTRATION.—Chloral is given only in aqueous solution, and the addition of mucilage or syrup, particularly of the syrup of orange-peel, will disguise its unpleasant taste. It is not well adapted to the hypodermic method, as painful phlegmons sometimes follow its repeated use. *Locally*, in dilution (gr. x to f℥j of water), or as an ointment (ʒss to ℥j), it is a good stimulant and deodorizing application to foul and fetid indolent *ulcers;* as an injection in *gonorrhœa* (gr. xx to f℥j of water), it answers well; and injected into subjects for the dissecting room (Keen, *loc. cit.*), and in the preservation of anatomical preparations, it has been also found useful (gr. xl to f℥j of water).

Croton-Chloral Hydrate (more correctly termed butyl-chloral hydrate) ($C_4H_5Cl_3O.H_2O$) is made by the action of chlorine upon ethylic aldehyde, and, when pure, occurs in beautiful white, silvery crystals, with a sweetish melon-flavor, only slightly soluble in water. Its action is *similar* to chloral, though thought to be feebler ; in addition it causes anæsthesia of the head. It is useful as an anodyne in *neuralgia* of the trigeminal, and also in chronic *cough*, in doses of from gr. xv–xx, dissolved in glycerin and syrup.

POTASSII BROMIDUM—POTASSIUM BROMIDE.

Preparation and Test.—Potassium bromide (KBr) is prepared by adding a solution of pure potassium carbonate to a solution of ferrous bromide. The iron is precipitated, and the potassium bromide remains in solution, from which it is obtained by evaporation. It occurs as a permanent, colorless, anhydrous, crystalline salt, of a pungent, saline taste, very soluble in water, and slightly so in alcohol. When mixed with starch, a yellow color is developed on the addition of chlorine. A bluish tint shows the presence of an iodide.

Incompatibles.—Acids, acidulous, and metallic salts decompose potassium bromide; with the alkaloids bromides are formed.

Aids.—Its action on the brain is enhanced by opium, chloral, cannabis Indica and similar agents; its depressing effects on the circulation by aconite, gelsemium, veratrum viride, etc.

Physiological Effects.—The statement of the action of potassium bromide is based on the investigations of Amory,* Bill,† Nuneley,‡ Bartholow,§ Lasègue,|| Damourette et Pelvet.¶ *Local* action: when applied to the pharyngeal mucous membrane, it is said to lessen the reflex irritability of the part. Nervous system: when brought in contact with the motor-nerves and spinal centres of the frog, potassium bromide destroys their functions. This action, however, is probably due to the potassium which it contains (Ringer), and is shared by the other potassium salts.

When administered *internally* (to animals), the irritability of the brain is decreased, owing in great part to the anemia caused by the action of the drug upon the vaso-motor nerves which govern the calibre of the vessels. Reflex irritability is diminished, partly on account of the paralyzing influence exerted on the reflex functions of the cord, and in part from paralysis of the end-organs of the peripheral nerves; on the latter account, also, cutaneous sensibility is lessened. It possesses a sedative action on the sympathetic system, giving rise to diminished cardiac action, decrease in the

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* Pamphlet, 1869. "Exper. upon the Phys. Action of Bromide of Potassium, etc."

† *Am. J. Med. Sci.*, July, 1868.

‡ *The Practitioner*, III, 347.

§ Pamphlet, 16 pp. "Exp. Investigation into the Actions and Uses of the Bromide of Potassium."

|| *Arch. Gén. de Médecine*, t. VI. 6ième ser., p. 81.

¶ *Bull. Gén. de Thérap.*, LXXIII, pp. 241, 289.

supply of blood to various organs, and slight reduction in the temperature of the body.

Circulation: topically applied to the heart (and voluntary muscles), it destroys their functions, as in the case of the topical application to the nervous centres, and probably for the same reason. In very large doses it lessens the frequency and force of the cardiac contractions, shortening the systole, prolonging the diastole, and, finally, paralyzing the heart in diastole. The tension of the arterial system is lowered. Respiration: it slows respiration and causes death by arrest of the respiratory centres (Ott). Temperature: in warm-blooded animals, toxic doses lower very decidedly the temperature, probably owing to a direct checking of tissue-changes. Secretion: at first the secretions and excretions are diminished, but, later, they are increased in amount. If a very large dose is taken, they are increased primarily. No lachrymation, salivation, or catarrh is produced, as after the administration of the iodides. After large doses, micturition is less frequent, because the vesical irritability is lessened,—not because the amount of urine is decreased. A very large dose may paralyze the sphincter and produce incontinence of urine. The amount of urea eliminated is diminished as is, also, the quantity of carbonic acid exhaled from the lungs, and the perspiration is decreased.

In man, the action of the bromides is similar to the action in animals; the cerebral symptoms being, however, more marked, because of the greater development of the hemispheres. Their taste is saline and disagreeable. When long continued, potassium bromide exerts a very marked depressing effect upon the sexual functions, enfeebling their vigor, and diminishing the sexual appetite. But these symptoms pass away when the drug is withheld. When considerable doses are given for a long period, a train of symptoms is produced to which the name *bromism* is applied. These are mental weakness, great drowsiness, failure of memory, anemia, malnutrition and depression of spirits, with often, impaired sensibility of the mucous and cutanous surfaces, diminution of the sexual functions, and an eruption of the skin (generally on the face and back), usually of acne, which rarely suppurates, occasionally of eczema, and, very rarely, rupial ulcers may be seen. Elimination: potassium bromide is eliminated chiefly by the kidneys; but also by the mucous membranes of the fauces, intestinal canal and bronchi, by the skin, and by the salivary glands. It is absorbed by the blood rapidly (Bartholow, *loc. cit.*) as traces may be found in the urine ten minutes after its administration, but elimination is slow. According to Amory (*loc. cit.*), it passes out, when given in medicinal doses, undecomposed, by the skin and kidneys. No case of acute poisoning by potassium bromide has been reported.

MEDICINAL USES.—From its action on the nervous system, potassium bromide is much used to quiet cerebral excitement and for its sedative effect on the reflex centres of the cord. And for this purpose it is of great value in *meningitis*, *cerebral* or *spinal*, to allay irritation and hinder convulsions.

As a narcotic (by causing anemia of the brain), it is much used in *insomnia* due to *cerebral hyperemia*, or even when not more than the normal amount of blood is sent to the brain; in wakefulness and wandering during *convalescence* from acute diseases; and in sleepessness due to worry, grief, dyspepsia, and over-work; also in cases of *night-horror*, in children, where they awake suddenly and scream with fright, often for a considerable time, small doses of this salt and a light supper will frequently effect a cure; adults subject to *nightmare* will find relief, too, in the temporary use of potassium bromide; to allay restlessness, remove delusions, calm delirium, and produce sleep in the early stages of *delerium tremens* and in *mania-à-potu*, it is given in doses of gr. xx to xxx every two hours until sleep is produced. It is more efficient in the early stages, and can be relied on with more certainty in the first than in subsequent attacks.

For the relief of uncomplicated *vertigo* it is of service, and it is one of the remedies used for *laryngismus stridulus*, and during the paroxysmal stage of *whooping-cough*. It may be prescribed also to stop obstinate *hiccough* and spasmodic pharyngeal *cough*.

In those functional cardiac affections in which excited or irregular action is a prominent symptom, as *irritable* or *over-acting heart*, or in *palpitation*, the bromides by lessening the frequency and force of the contractions, render important service. In the last two conditions aconite is a valuable adjuvant.

Potassium bromide is often combined with other narcotics, as opium, chloral, etc., to aid their action, and even to modify their disagreeable effects. It will generally prove beneficial in women suffering from *nervousness;* great despondency, amounting to a feeling of approaching madness; irritability; lack of interest in their surroundings; sleeplessness and harassing dreams, caused by overwork, want of change, grief, or worry. If the medicine does not succeed alone, it will when combined with a change of scene. In some cases of *hysteria*, potassium bromide is a valuable remedy. In all forms of *convulsions* (epilepsy, chorea, convulsions of Bright's disease, convulsions of children, etc.) it will prove beneficial, by diminishing the reflex function of the cord.

In *epilepsy* the bromides are preëminently of service, lessening the frequency of the attacks, if not absolutely preventing their recurrence. It is stated by Trousseau that they are less efficient in attacks of *petit mal* than in those of severer form; but Dr. A. Hughes Bennett has recently published a number of cases of the lighter variety, in the majority of which the bromides proved successful. They should be given in doses sufficient to prevent reflex retching or nausea, when the fauces are tickled (Voisin), and must be continued for years, with an occasional intermission of a week or two.

Potassium bromide has been successfully used in the treatment of *strychnine-poisoning;* it should be given in doses of ʒij, frequently repeated, as the case may require. It has also been successfully used in *tetanus*. It has been recommended during *dentition*, to allay irritability and restlessness and to prevent convulsions. It is administered for the relief of the convulsions of *uremia*, and the *puerperal state*. In the reflex forms of vomiting, as the *vomiting of pregnancy*, of *sea-sickness*, and in *migraine* or sick headache (especially in the congestive forms), it is sometimes beneficial. In the *colic* of infants, unaccompanied by diarrhœa, it is an excellent remedy, relieving pain and spasm, and producing sleep. It is used, too, in large doses, ʒj or more, to obtund the sensibility of the fauces, before the exhibition of the laryngoscope, but this is going out of fashion since the introduction of cocaine.

From its sedative influence on the organs of generation, it is used with success in *nymphomania*, *spermatorrhœa*, *masturbation*, and *chordee*. In the last affection it may be taken in large doses throughout the day, the final one before retiring. It decreases the flow of blood in *menorrhagia*. The flushes of heat, followed by sweating and prostration, occuring at the *menopause*, are generally cured by the use of potassium bromide.

Administration.—Dose, gr. v–ʒj or more. In epilepsy it is given in doses of gr. xx–xxx, thrice daily, and continued for a long period, with occasional intervals of a week or two. If bromism occur, stop the remedy for the time, and give tonics. The bromide rashes are easily cured by withdrawing the medicine, and giving liquor potassii arsenitis internally in small doses, and the local use of an ointment containing iodide of sulphur. Potassium bromide should be administered in solution, aud preferably between meals. It may be disguised with simple elixir.

AMMONII BROMIDUM—AMMONIUM BROMIDE.

PREPARATION.—Ammonium bromide (NH_4Br) is prepared by mixing bromine with iron-wire in distilled water, agitating the mixture until the liquid assumes a greenish color, and then adding water of ammonia to the mixture, which precipitates the iron as ferrous hydrate, ammonium bromide remaining in solution. By filtration and evaporation, a white, granular salt is obtained, which, on exposure to the air, gradually becomes yellowish (in consequence of the liberation of hydrobromic acid), has a saline, pungent taste, is very soluble in water, and moderately so in alcohol.

INCOMPATIBLES AND AIDS.—See potassium bromide.

PHYSIOLOGICAL EFFECTS.—The action of ammonium bromide *resembles*, in many respects, that of the potassium salt. When applied *locally* to the motor nerves, spinal centres, heart, or voluntary muscles, it does not destroy their functions, and has less influence, when administered *internally*, on the circulation, respiration and temperature.

MEDICINAL USES.—It has been used for the same conditions in which potassium bromide is given. Echeverrhia prefers the ammonium bromide in *epileptic* maniacal excitement, but states that it will fail unless combined with chloral, cannabis Indica, or other narcotic, or better still, with ergot. The combined use of ammonium and potassium bromide has been recommended by Brown-Séquard. Da Costa highly recommends its use in *acute rheumatism*. It has also been given with advantage in *whooping-cough*.

ADMINISTRATION.—It is given in doses of gr. v–xxx, thrice daily, and is best administered in some bitter infusion, or simple elixir.

Sodii Bromidum (*Sodium Bromide*) (NaBr) may be prepared in a similar manner to potassium bromide.

In its *physiological effects* it resembles potassium bromide, but is much feebler.

It is *used* in the same diseases and in the same doses as is the potassium salt.

Lithii Bromidum (*Lithium Bromide*) (LiBr) has been recommended as the most efficacious of the bromides. S. Weir Mitchell has found it efficient in gr. x–xx doses, in some cases of *epilepsy*, after the potassium bromide had failed. It has been used in *gout*, but not with much success. It contains a larger per cent. of bromine than do the other salts, and is very soluble.

Calcii Bromidum (*Calcium Bromide*) ($CaBr_2$) has been employed for the same purposes and in the same doses as potassium bromide.

Zinci Bromidum (*Zinc Bromide*) ($ZnBr_2$) has been prescribed in the treatment of *epilepsy*, but its use is not general. Hammond * has obtained beneficial results with the salt in arresting the *epileptic paroxysms* where the other bromides had failed, and it has the advantage of not causing bromism or a cutaneous eruption. Dose, gr. ij–xx, in syrup and water.

Recently *strontium bromide* has been introduced. It is stated not to cause the bromide eruptions, or disorder of the stomach; recommended in *gastralgia* and *dyspepsia*, with pain. Dose, gr. x–xxx, in syrup and water.

Acidum Hydrobromicum Dilutum (*Diluted Hydrobromic Acid*) is a clear, colorless liquid, without odor, but having a strongly acid taste, which consists of 10 per cent. of absolute hydrobromic acid (HBr), and 90 per cent. of water. It has a sp. gr. of 1.077.

EFFECTS AND USES.—This acid does not differ materially in its action from potassium bromide, and has been used as a substitute for it in *epilepsy*, *alcoholism*, *congestive headache*, *vertigo*, *chorea*, *insomnia*, *hysteria*, etc. It has been recommended to combine it with quinine as a preventive of cinchonism. Its value does not seem to be very firmly established. Dose of the diluted acid, f℥ss–ij.

TABACUM—TOBACCO.

Nicotiana Tabacum, or Virginia Tobacco (*Nat. Ord.* Solanaceæ), is a native of the warm countries of America. It is an annual plant, growing to the height of from three to six feet, with large oblong, pointed, hairy, pale-green leaves, and light-greenish, funnel-shaped flowers. The DRIED LEAVES are the portion used. They have a yellowish-brown color, a strong, peculiar, narcotic odor, and a bitter, nauseous taste. The darker-colored leaves are the strongest.

CHEMICAL CONSTITUENTS AND TEST.—The virtues of tobacco are imparted to alcohol and water, and depend on the presence of an alkaloid called *nicotine* ($C_{10}H_{14}N_2$) (as a malate), which is found in all parts of the plant, but not in tobacco-smoke. It is a colorless, oily, volatilizable, alkaline liquid, highly soluble in water, alcohol, ether, chloroform, the fixed oils, and oil of turpentine, of a feeble odor when cold, but irritant when heated, of an acrid, burning taste, and is a most energetic poison, ranking after prussic acid. From the dried leaves are also obtained a concrete volatile oil, termed *nicotianin*, which is probably the odorous principle of the plant, and an *empyreumatic* oil, which gives the peculiar smell to old tobacco-

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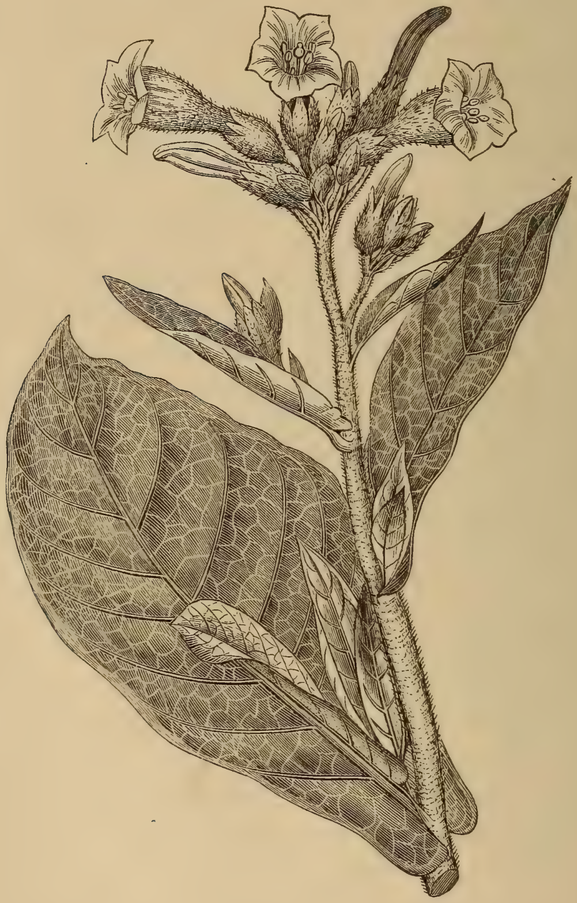
* "A Treatise on Diseases of the Nervous System," 1888, p. 716.

FIG. 27.



TOBACCO.

pipes. Both of these principles are poisonous. Tobacco-smoke * has been found " to contain numerous basic substances of the picolinic series, and ceded to caustic potash, hydrocyanic acid, sulphuretted hydrogen," with fatty acids, phenol and creasote. *Test.*—Nicotine is thrown down from aqueous solution as a yellowish-white precipitate by platinum perchloride.

INCOMPATIBLES.—Tannic acid and the caustic alkalies.

AIDS.—The depresso-motors, as physostigma, woorara, etc.

PHYSIOLOGICAL EFFECTS.—*Local action:* applied to the skin tobacco is readily absorbed. On persons unaccustomed to its use, tobacco, in small doses, produces nausea, depression, and a feeling of wretchedness. Nervous system: tobacco expends its action on the spinal cord, and not upon the brain, and nicotine, in full doses, acts as a tetanizing agent on man. Nicotine contracts the pupil either locally or internally. The conductivity of the motor nerves is more or less abolished, and lastly that of the spinal cord, while the voluntary muscles remain unaffected. These remarks apply to lethal doses of the drug. Circulation: the red globules of the blood of a person under the influence of tobacco present a crenated appearance. Tobacco is not a cardiac poison, since the application of nicotine to the cut-out heart will not stop its beats; nevertheless it slows the cardiac action and temporarily reduces the blood-pressure. Intestines: tobacco has a relaxing influence upon this tract, and the injection of nicotine induces intestinal peristalsis. Nicotine is probably eliminated by the kidneys.

The habitual use of tobacco-smoke as an exhilarant is well known. When taken to excess, it frequently develops maladies of the stomach, heart, nervous system, and upper air-passages. Under its immoderate use such cardiac phenomena as overaction and palpitation are likely to ensue, and the use of tobacco is contraindicated when these conditions exist. Tobacco smoking is least injurious when not inhaled.

TOXICOLOGY AND ANTIDOTES.—In lethal doses, it induces vomiting and purging, a sensation of sinking at the pit of the stomach, giddiness, disorder of vision, contraction of the pupils, depression of the circulation, great relaxation of the muscular system, coldness of the surface, and other symptoms of prostration; and, when excessive doses have been taken, these symptoms become more violent, and are followed by clonic convulsions, paralysis and death. Woodman and Tidy* have collected a number of fatal cases from the use of the infusion of tobacco by clyster and injection, so that it is a remedy, even locally, to be employed with caution. Cases of poisoning are to be treated with the diffusible stimuli, after washing out the stomach, and *strychnine* is to be used hypodermically; dry heat should also be applied, and, if these means fail, artificial respiration should be resorted to.

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* Pharmacographia," 2d ed., p. 468.

MEDICINAL USES.—Tobacco is employed in medicine chiefly with a view to its action on the muscular system—its anodyne properties being relatively feeble. In various spasmodic diseases, particularly in *colic*, *strangulated hernia*, *tetanus* and *asthma*, it was formerly considered a remedy of great value, but more efficacious ones have superseded it. Tobacco is to be employed with caution, as it occasionally acts with dangerous energy. It is now rarely used medicinally.

ADMINISTRATION.—Tobacco is not given by the stomach, owing to its emetic properties. It is usually administered by the rectum, in the form of infusion, or tobacco-smoke may be introduced into the rectum. It may also be smoked for medicinal effect, or applied *locally* in the form of cataplasm. The oil is sometimes mixed with ointments.

LOBELIA.

Lobelia inflata, or Indian tobacco (*Nat. Ord.* Lobeliaceæ), is a very common annual or biennial indigenous plant, growing to the height of from six inches to two feet, having an erect, hairy stem, ovate, serrated leaves, pale-blue flowers, and ovoid, inflated capsules. All parts of it are active, but the LEAVES and TOPS only are official.

CHEMICAL CONSTITUENTS.—Water and alcohol extract the virtues of lobelia, which contains a partly volatile alkaloid, *lobeline*, *lobelic acid*, *fixed* and *volatile oil*, *gum*, *chlorophyll*, etc. Lloyd† regards the alkaloid as a fixed one; he also isolated a substance termed *inflatin*. Lobeline is a yellowish liquid, lighter than water, of an aromatic odor, an acrid taste, soluble in water, but more so in alcohol and ether.

INCOMPATIBLES.—The caustic alkalies decompose lobeline.

AIDS.—The depresso-motors.

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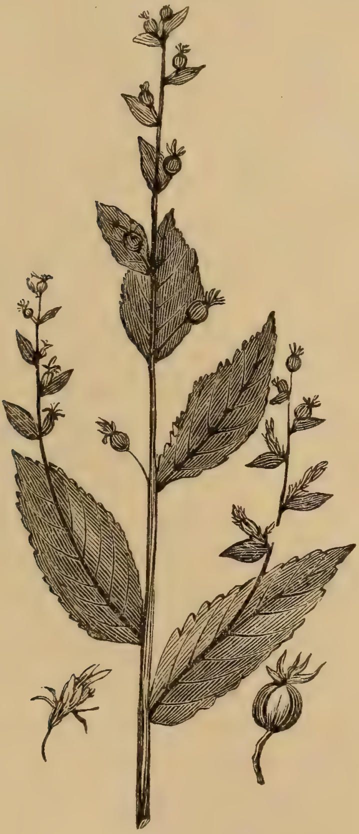
* "Forensic Medicine, etc.," 1882, p. 381.

† "Drugs and Medicines of North America," Vol. II, p. 75.

Physiological Effects.—Lobelia produces effects on the system *analogous* to those of tobacco, acting in small doses as a *sedative*, *nauseant* and *diaphoretic*. According to Ott's * investigations the alkaloid produced in the rabbit curious alterations of blood-pressure, viz.: first a fall, followed generally by a rise, and lastly a very decided fall; also slower respiration, paralysis, reduction of temperature, and death from asphyxia. Lobelia, like tobacco, retards the heart's action, is said to increase the urinary flow, and, in an unexplained way, relieves bronchial spasm. Complete in-

Fig. 28.



LOBELIA INFLATA.

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* "*Boston Med. and Surg. Jour.*, 1875.

vestigations of its action have not yet been made. There are on record numerous cases of death from lethal amounts of lobelia. In large doses it is an energetic emetic; and in still larger doses destroys life by paralyzing the respiratory centre in the medulla oblongata, the pupil being contracted. The peculiar depressing effects excited by lobelia upon the circulatory apparatus may be counteracted in a measure by the cardiac excitants as ether, alcohol, ammonia and strychnia. It was employed by the aborigines, and has always been a popular empirical remedy.

MEDICINAL USES.—Lobelia is sometimes classed among emetics, but its action in this particular is too violent for its safe administration. It is chiefly employed, by regular practitioners, in virtue of its bronchial *antispasmodic properties for the relief of asthma, angina pectoris*, and *cardiac dyspnœa*, and it is given in small doses, gradually increased until headache or nausea ensues. In asthma, Ringer advises lobelia to be given in large doses, viz., fʒj of the tincture every hour, or even every half-hour. The chief draw-back to its use is its uncertainty and the nausea and depression induced by it. In asthma it possesses no curative power, seeming to be beneficial by reason of its antispasmodic and expectorant properties. It may also be used as an enema, to fulfill the same indications as tobacco.

ADMINISTRATION.—Lobelia is given in substance, tincture, and infusion. The dose of the powder as an antispasmodic is gr. j-iij; as an emetic, gr. v-xx. The best form, particularly in asthma, is the *tincture* (20 per cent., in diluted alcohol), which may be given in the quanity of fʒss-j, to be repeated as occasion may require. A *fluid extract* is also official; dose ♏j-xxx.

Acetum Lobeliæ (*Vinegar of Lobelia*), made with diluted acetic acid, is a good preparation, in which the alkaloid is fixed by the acetic acid; it contains 10 per cent. of lobelia. Dose, as an *expectorant*, fʒss-j; as an antispasmodic and nauseant, fʒj-ij.

ACIDUM HYDROCYANICUM DILUTUM——DILUTED HYDROCYANIC ACID.

Hydrocyanic acid, known also as cyanhydric acid and *prussic* acid, is derived from a variety of vegetable substances, as the bitter almond, peach-kernels and leaves, wild cherry, cherry-laurel, etc. It is employed in medicine only in a state of extreme dilution; and the diluted acid is obtained by the action of sulphuric acid and water on potassium ferrocyanide, or when wanted for immediate use, by the action of hydrochloric acid and water on silver cyanide.

CHEMISTRY AND TESTS.—*Diluted hydrocyanic acid* is a colorless, volatile liquid, with a peculiar odor and a cooling, somewhat irritating taste. It undergoes decomposition if exposed to the light, and should be kept in bottles covered with black paint or paper; but it is not a stable preparation. It contains two per cent. of the anhydrous or concentrated acid.

The *anhydrous acid* (HCy or HNC) is a colorless, feebly acid, transparent, very volatile and decomposable liquid, with a powerful, peculiar odor, and a cooling, afterward burning taste. Both water and alcohol dissolve it readily. *Tests.*—Its presence in a suspected mixture may be detected by the addition of a solution of silver nitrate, which throws down a white, curdy precipitate of silver cyanide, distinguishable by its giving off, when dried and heated in a test tube, cyanogen gas which burns with a rose-colored flame (the silver test is the most delicate, when applied to prussic acid in the state of *vapor*); or, by adding to the suspected solution a little liquor potassæ, and then a mixed solution of ferrous and ferric sulphate, a dirty greenish-blue precipitate is thrown down, which, on the addition of a few drops of pure hydrochloric acid becomes *Prussian* blue (the best *liquid test*).

INCOMPATIBLES.—The metallic salts.

PHYSIOLOGICAL EFFECTS.—*Locally:* hydrocyanic acid applied directly to the skin exerts a benumbing influence, and may be absorbed with the aid of friction; to a mucous membrane or wound it is readily taken up. Nervous system: in small doses it produces no symptoms beyond a calming effect. Full doses cause giddiness, confusion of mind, and muscular feebleness. Whether large doses act on brain, vagus, or peripheral nerves is disputed. The convulsions which it produces are cerebral, for they do not occur in parts cut off from the cord. In the frog, Kölliker* finds that the direct application of hydrocyanic acid paralyzes the motor-nerve trunks, and destroys the irritability of muscle, and upon the peripheral sensory nerves acts as a paralyzant.

Since hydrocyanic acid produces asphyxia most rapidly in the form of vapor, Preyer concludes that it acts directly on the pulmonary ends of the vagi. That it acts directly on the nerve-centres is supported by the experiment of Jones,* in which the application of the acid to the medulla of an alligator caused quickly collapse of the lung. Circulation: prussic acid in small doses has a sedative action on the heart; large doses arrest it in diastole (Lecorché et Meuriot†). When applied directly to the heart it suspends the movements. Under prussic acid a temporary increase of the arterial pressure, followed by a permanent reduction, has been observed. But this is not in accordance with Lecorché and Meuriot's (*loc. cit.*) investigations. It is only in lethal doses that opinion is unanimous as to a decided reduction of blood-pressure.

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* *Arch. für Pathol. Anat.*, Bd. x, p. 272.

Respiration: nothing short of 10–15 minims disturbs this act, this amount rendering it labored and irregular. Large doses destroy life so quickly that the respirations cannot be counted. Prussic acid has no influence on temperature, or secretion, save a slight augmentation of the saliva. Elimination is rapid, taking place by the saliva, kidneys and lungs. Opinions as to the action of prussic acid on the blood are contradictory. During life, under hydrocyanic acid, the venous blood is found to have an arterial hue; while in man and mammals, after death this fluid is dark colored, probably from deficient abstraction of carbon dioxide. Outside of the economy the addition of hydrocyanic acid to the blood produces a new body, formed from HCy and hemoglobin, called cyanohemoglobin (Hoppe-Seyler‡), which has no ozonizing power, and it seems probable that the formation of this substance, if it take place during life in the blood, may be one of the main factors in causing death.

Toxicology.—In a poisonous dose, hydrocyanic acid arrests life with fearful rapidity, and it is one of the most energetic poisons known, one or two drops of the pure acid being sufficient to destroy a dog in a few seconds, and gr. $\frac{9}{10}$ § of the anhydrous acid killed an adult in twenty minutes. When not immediately fatal, it produces great and sudden prostration, difficult and spasmodic respiration, dilatation and immobility, and sometimes contraction of the pupils, feeble pulse, diminution of temperature in the extremities, rise in the trunk at first, but followed by a fall, and involuntary evacuations. It acts on both the voluntary and involuntary muscles, decreasing or arresting entirely their property of contractility; both the sympathetic and cerebro-spinal nervous systems appear to be affected.

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* *N. Y. Med. Record*, II, 1867, 456.

† *Arch. Gén. de Médecine*, 6 ser., xi, p. 529. Étude Phys. et Thérap. sur l'acide cyanhydrique.

‡ *Virchow's Archives*, XXXVIII, p. 435. "Ueber die Ursache der Giftigkeit der Blausäure."

§ "Taylor's Med. Jurisprudence," 3d Am. ed., 142.

ANTIDOTES.—The best *antidotes* are inhalations of ammonia or its carbonate, and (if the patient can swallow) alcoholic stimuli are to be employed, and at the same time *cold and hot affusions and artificial respiration* must also be resorted to. The subcutaneous injection of *atropine sulphate* has been proposed as a physiological antidote, but its rate of diffusion is too slow to be of service, while Boehm * states that it is not antagonistic at all.

MEDICINAL USES.—Hydrocyanic acid is a valuable agent in allaying *spasm*, *pain* and *nervous irritability*, in a variety of disorders, and is much used to relieve *cough*, particularly in phthisis pulmonalis, and for its antispasmodic virtues in *asthma* and *whooping-cough*. It is, moreover, a most efficacious remedy in *gastrodynia* and in neuralgic affections of the bowels, and also in *chronic vomiting*. *Topically*, it is employed as an anodyne in *neuralgia*, and in various forms of cutaneous disease (fʒj–iij to water Oj–iss), notably *urticaria* and *prurigo*, as an antipruritic lotion.

ADMINISTRATION.—The dose of the official acid is gtt. i–ij, to be repeated and gradually increased by a drop till some effect is perceptible. When it is taken for a length of time, care should be observed to have the medicine, as renewed, of uniform strength; and it is best, in using a fresh sample, to return to the minimum dose.

Potassii Cyanidum (*Potassium Cyanide*, KCN), is used as a substitute for hydrocyanic acid, and has the advantage of being a more uniform chemical product, and less liable to undergo decomposition. It is made by heating together potassium ferrocyanide and potassium carbonate, and occurs in white, opaque, amorphous pieces, having a sharp, somewhat alkaline and bitter-almond taste, and an alkaline reaction; its solution yields the odor of hydrocyanic acid when exposed to the air. It is deliquescent, very soluble in water, and sparingly so in alcohol. For medicinal use it should be purified by solution in, and crystallization from, alcohol. Its *medicinal* and *poisonous* effects are the same as those of hydrocyanic acid.

ADMINISTRATION.—Dose, gr. 1/8 in f℥ss of distilled water, to be repeated and increased. The addition of a few drops of some vegetable acid frees the hydrocyanic acid, and the same effect is produced by the acids of the stomach. Lethal effects may be obtained by prolonged contact with the skin. It is also *irritant*, and will produce an eschar. As much as gr. iij have been taken by an adult without fatal results (Taylor *).

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* *Practitioner*, XIII, p. 168.

Oleum Amygdalæ Amaræ (*Oil of Bitter Almond*) contains hydrocyanic acid, and may be used for the same purposes. It is obtained by distillation from the kernel of the fruit of Amygdalus communis, variety *Amara* (*Nat. Ord.* Rosaceæ), and is of a yellowish color, with a bitter, acrid, burning taste, and the peculiar odor of the bitter almond, which is different from that of hydrocyanic acid. It is heavier than water, slightly soluble in it, and soluble in alcohol and ether.

Chemical Constituents.—It contains *benzoic aldehyde* and *hydrocyanic acid*, which are developed from a principle termed *amygdalin*, and water, under the influence of an albuminous ferment termed *emulsin:* thus, amygdalin ($C_{20}H_{27}NO_{11}$) + water ($2H_2O$) = benzoic aldehyde (C_7H_5OH) + HCN + glucose ($2C_6H_{12}O_6$).

Effects and Uses.—The action of this oil upon the system is closely analogous to that of hydrocyanic acid, and its strength is about four times that of the diluted official acid.

Administration.—Dose, for *internal* use, gtt. ¼–½ in emulsion; as an *external* application, gtt. j to a f℥j of menstruum. *Bitter Almond Water* (*aqua amygdalæ amaræ*) is used as a vehicle for narcotic medicines containing one part of the oil dissolved in 999 parts of distilled water. Dose, f℥ss.

Syrupus Amygdalæ (*Syrup of Almond*), made from both the sweet and bitter almonds, is slightly impregnated with the virtues of hydrocyanic acid, and is a pleasant vehicle for cough-mixtures. (For *mistura amygdalæ* see index.)

AMYL NITRIS—AMYL NITRITE.

Preparation.—Amyl nitrite ($C_5H_{11}NO_2$) is prepared by heating one part of strong nitric acid with two parts of rectified fusel oil (amylic alcohol or amyl hydrate—$C_5H_{11}HO$) until it approaches boiling, when the fire is removed. After the violent reaction has subsided, heat is again carefully applied. The distillate obtained below 212° F. is rectified over potassium carbonate, with the precaution to collect only that portion distilling between 202° and 206° F. It is a clear amber-colored, *volatile*, inflammable liquid, of sp. gr. 0.872 to 0.874, boiling at about 205° F., giving off an orange-colored vapor. It has an odor and taste like that of ripe pears. It is insoluble in water, but soluble in all proportions in alcohol, ether and chloroform. Amyl nitrite should be kept in small glass-stoppered bottles, in a dark and cool place.

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* *Guy's Hospital Reports*, XIII, 1868.

AIDS.—The depresso-motors, though on account of its peculiar nature it should be prescribed alone.

PHYSIOLOGICAL EFFECTS.—The following account is based on the investigations of H. C. Wood,[*] Amez-Drozand,[†] and Lauder Brunton.[‡] When amyl nitrite is *inhaled*, it causes flushing of the head and face, a feeling of oppression in the head, with vertigo, excited cardiac action, diminished blood-pressure, *marked dilatation of the arterial system*, from paresis of the muscular coat of the vessels, due to direct action of the drug (Lauder Brunton, *loc. cit.*), lowering of temperature, retarded respiratory movements, which tend to become slower as the administration is pushed, and eventually are extinguished, from a paralyzing influence on the respiratory centre. At the same time there is complete motor-paralysis. Consciousness is not destroyed, unless a condition approaching death is produced.

The violent action of the heart is due, probably, to depression of the cardiac inhibitory nerves. On the reflex function and spinal motor centres, amyl nitrite acts as a powerful paralyzer. It also lessens the functional activity of the muscles and nerves. Dilatation of the vessels of the retina has been observed by the ophthalmoscope. Amyl nitrite has the property of diminishing the oxidizing function of the red blood-corpuscles, uniting with them to form a new compound, methemoglobin, which is not as readily deoxidized as hemoglobin, but which may be again converted into the latter by reducing agents. Whether inhaled or administered internally, amyl nitrite increases to a marked degree both the quantity of urine passed and the amount of uric acid and urea eliminated. Sugar has been found in the urine of rabbits to which the drug had been administered by hypodermic injection. Its lethal effects are antagonized by those agents which excite the functional activity of its spinal cord, as strychnia, picrotoxin, etc.

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[*] *Am. J. Med. Sci.*, July, 1871, p. 39.

[†] *Arch. de Phys. Norm. et Pathol.*, V, 1863, 467.

[‡] *Journ. of Anat. and Physiol.*, V. p. 92.

MEDICINAL USES.—It has been *employed* to rouse the system in cases of *syncope* and prostration, as an antidote to *chloroform poisoning*, and it has been found efficacious in relieving the pain of *angina pectoris*, *puerperal eclampsia*, and other convulsive diseases, and Frazer* has recently called attention to the value of the inhalation of amyl nitrite to relieve the dyspnœa of *asthma.* In uremic asthma especially are the good effects of an inhalation of the drug seen, the relief being very speedy, the quantity of urine much augmented, and the amount of albumen lessened, at the same time the œdema decidedly subsides (Ringwood; Rossbach; Mya). In dyspnœa due to *cardiac failure*, it is also beneficial. In *dysmenorrhœa* of the so-called congestive form, it often proves serviceable. The inhalation of the vapor of the nitrite has also been found efficacious in arresting *epileptic seizures*, when their approach is indicated by the *aura epileptica;* and also in *tetanus*, *nausea marina*, and *strychnine poisoning.* Dr. Macdonald † recommends its use in *gout*, on account of the rapid elimination of uric acid which it causes.

It is indicated in all conditions where there is a high degree of tension of the arterioles.

ADMINISTRATION.—It may be conveniently carried in glass-pearls by patients requiring its prompt action, or ♏j–v can be inhaled from a crushed capsule.

The following drugs, although not official, are deserving of notice in connection with amyl nitrite.

Nitroglycerinum (*Nitroglycerin—Trinitroglycerin—Glonoin* ($C_3H_5(NO_3)_3$) is made by the action of sulphuric and nitric acids on glycerin, and occurs as a colorless or pale yellowish, oily liquid, with a sp. gr. 1.600; it crystallizes in long needles if kept for some time at the temperature of 32° F.; is nearly insoluble in water, but readily soluble in alcohol and ether. It is without odor. Nitroglycerin forms the basis of various explosives, as *dynamite*, *giant powder*, etc., and will itself explode with great violence if heated in a closed vessel or if forcibly percussed. Hay ‡ has made some experiments which seem to show that nitroglycerin is a nitrate of glyceryl.

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* *Am. J. M. Sci.*, Oct., 1887, p. 393.

† *Brit. Med. Journ.*, 1885, p, 1039.

‡ *The Practitioner*, xxx, p. 422.

Physiological Effects.—The effects of nitroglycerin resemble those of amyl nitrite and the other nitrites, but are more persistent. Hay (*loc. cit.*) considers their similarity of action to be due to the *nitrous radical* contained in each, which coincides with the view expressed by a recent experimenter (Armstrong[*]) and it appears to be substantially correct. When inhaled it causes flushing of the face and headache. Given *internally*, in small doses[†] (gr. $\frac{1}{100}$), its taste being sweetish and pungent, it causes very great acceleration of the pulse and respiration, diminished blood-pressure, flushed face, a feeling of tension and throbbing, and severe *headache*, pharyngeal constriction, diaphoresis, all lasting some hours. After larger doses all of these symtoms are intensified; there is gradual paralysis of reflex and voluntary motions, loss of sensation, and finally death from paralysis of respiration. Injected into cats Brunton[‡] found that it produced paralysis without tetanus, and in addition it poisoned the muscles. On the motor-nerves its action is uncertain. It paralyzed the cord before the ganglia at the base of the brain; slowed the action of the heart directly, and reduced the blood-pressure. It is decomposed by the alkalies in the blood, the greater portion of the nitric acid of the compound being converted into nitrous acid and combining with alkaline bases, forming nitrites which lessen the oxidizing power of the red corpuscles and cause both arterial and venous blood to assume a dark chocolate hue. Nitroglycerin is a muscle-poison, and when applied directly to the heart of the frog causes paralysis of that organ. Prof. Rossbach, of Jena, finds it greatly increases both the quantity of the urine and the amount of uric acid and urea present.

Toxicology.—Three fatal cases[§] are recorded, but the amount is not given. Its poisonous effects are antagonized by the same agents as for amyl nitrite.

Medicinal Uses.—Nitroglycerin is used to relieve the tension of the vessels, as in *angina pectoris*, in which disease there is pre-eminently a high arterial tension. If taken at the beginning of the attack of *asthma* (especially if due to emphysema), it will frequently give good results (Korczynski). In uremic asthma it is often useful, but if the symptoms are urgent, it is best to let the patient in-hale amyl nitrite until the danger is abated, after which nitroglycerin should be administered.

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[*] *Med. Times*, Feb., 1888, p. 260.

[†] *British Med. Journal*, March, 1880, vol. 1, p. 406, article on nitro-glycerine.

[‡] *St. Bartholomew's Hospital Reports*, xii, 1876, p. 140.

[§] Woodman and Tidy, 1882, p. 464.

In *purperal eclampsia* it has been of great service, and has also been recommended in dyspnœa, due to *cardiac failure*, and in *weak-heart*, or where fatty degeneration of the cardiac muscle is taking place; although many prefer the use of amyl or other nitrite in these cases. It is also useful in *Bright's disease*, both in the acute and chronic forms. It sometimes affords relief in *neuralgias*, in *gastrodynia*, and in *hepatic colic*, and has been found useful to arrest the vomiting of *sea-sickness*. It has also been prescribed with success in the cold stage of *intermittent fever*, as by dilating the vessels it will frequently abort or cut short the attack.

ADMINISTRATION.—It is best given in one per cent. solution in alcohol, of which the dose is ♏ss–x. It is best to begin with a small dose and gradually increase it.

Potassium Nitrite and **Sodium Nitrite** have been introduced into practice as being similar in effects and uses to those of amyl nitrite and nitroglycerin, and this similarity has recently been corroborated by Armstrong (*loc. cit.*) and Reichert* in some experiments on the pharmacology of the nitrites. Dr. Matthew Hay† believes the sodium salt to be as active and reliable in *angina pectoris* as either of the above drugs, and prefers it, because when used in medicinal doses, it does not cause the headache, giddiness, or even partial collapse, which are sometimes seen after their use. The nitrites have recently been recommended in *asthma* by Fraser. Dose, gr. iij–v or more, in aqueous solution.

GELSEMIUM.

Gelsemium sempervirens, Yellow or Carolina Jasmine (*Nat. Ord.* Loganiaceæ), is a beautiful climbing plant of our Southern States, with a twining, smooth, and shining stem, perennial, dark-green leaves, and beautiful, very fragrant flowers, of a deep-yellow color. The RHIZOME and ROOTLETS are official. The true root is hard and woody, slightly undulated in outline, sparingly branched, externally of a pale-brown color, smooth, and furnished with a thin scurfy cuticle, slightly cracked longitudinally. The stem is rougher externally, and is distinguished from the root by a small central cavity, representing the pith. The stem should be rejected. The root has a bitter and pleasant flavor, and an odor somewhat between that of senega and green tea.

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* *Am. Jour. Med. Sci.*, Vol. 80, p. 158.

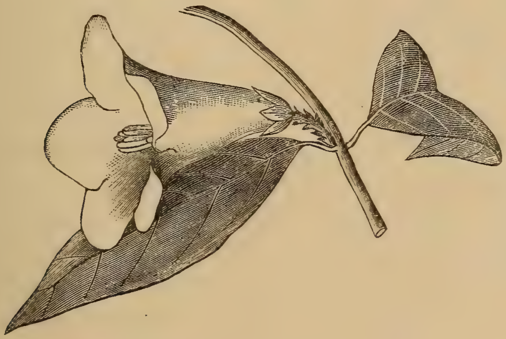
† *Practitioner*, March, 1883.

Chemical Constituents.—It contains an alkaloid termed *gelsemine*, combined with an acid called *gelseminic*, both discovered by Wormley* (not identical with æsculin), a *volatile oil*, an acrid *resin*, etc. The alkaloid, which represents chiefly the physiological action of the drug, though Ott† has shown gelseminic acid, gr. j–½ injected into cats to be a fatal tetanizer, is a powerful poison.

Imcompatibles.—The caustic alkalies and tannic acid precipitate the alkaloid.

Aids.—The depresso-motors as, tobacco, physostigma, conium, etc.

Fig. 29.



GELSEMIUM SEMPERVIRENS.

Physiological Effects.—The action of gelsemium has been investigated and described by the following observers, viz., Bartholow,‡ Ott (*loc. cit.*), Ringer and Murrell§ and Holmes,‖ as follows: Gelsemium in moderate doses, causes languor, dizziness, disordered vision and frontal pain, but hardly affects the circulation. Large doses diminish the pulse and blood-pressure by direct action on the heart, lower the temperature of the body, lessen respiration, and dilate the pupils, with little or no nauseating or purgative effect, nor does it exhibit any characteristic influence upon the brain. Ott's (*loc. cit.*) conclusions are these, viz., that gelsemine has no action on the motor or sensory nerves, nor on muscular contractility, which are in accord with those of Bartholow (*loc. cit.*); the last observer concludes that its paralyzing influence is due to a direct action on the motor and sensory centres of the cord. It appears to slow the heart by direct action, and it destroys life by paralysis of respiration. By summing up its action, after examining the effects of lethal doses, and the results of experiments, we can deduce the fact that gelsemium is a powerful depressant, not only of the motor, but also of the sensory centres, in the spinal cord.

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* *Am. Journ. of Pharm.*, Jan., 1870, and July, 1882.

† *Phil. Med. Times*, V, July, 1875, and March 31, 1887.

‡ *The Practitioner*, V, p. 200.

§ *The Lancet*, Jan. 15th, 1876.

‖ *Annuaire de Thérap.*, 1877, p. 41.

TOXICOLOGY AND ANTIDOTES.—In overdoses, it has rapidly produced death, with great muscular relaxation, want of coördination in the movements, difficulty of speech, double vision, dilatation of the pupils, failure of the pulse and respiration, coldness of the surface, and finally unconsciousness preceding death. Ott* has collected six cases of fatal poisoning by Gelsemium, the minimum dose being fʒj of the fluid extract. An amount of gelsemium estimated to contain gr. $\frac{1}{8}$ of gelsemine has proved fatal to an adult woman. Its lethal effects are counteracted by the cardiac and motor-excitants, as strychnia, ammonia, alcohol, etc.

MEDICINAL USES.—It has been used in *fevers*, *inflammations*, essential spasmodic affections, as *tetanus*, *paralysis agitans*, and as an hypnotic in *delirium tremens* and other forms of morbid wakefulness, and as an anodyne in *trifacial neuralgia*. As a calmative in *acute mania* it has been given in full doses, and as a depresso-motor against erotic desires leading to *masturbation*. Bartholow recommends gelsemium in acute inflammations of the lungs and pleura, especially in *pneumonia* and *pleurisy*. He gives the fluid extract ♏v–x every two hours "to maintain a constant effect within the limits of safety." Bulkley† advises the internal use of tincture of gelsemium gtt. x, repeated, to relieve the itching of *acute eczema* and *prurigo*.

ADMINISTRATION.—The *tincture* of gelsemium is the form which has been heretofore employed, in the dose of ♏v–xx; but the *fluid extract* should be preferred, dose, ♏v–x; fʒj of this has proved fatal.

WOORARA.

This substance, termed also *woorari*, *woorali*, and *curare*, has long been known as a powerful poison prepared by the Indians, in

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* *Phila. Med. Times*, Vol. v, p. 689.

† *N. Y. Med. Journ.*, Jan., 1881.

South America, and of late years has been employed as a medicine. Its source is unsettled, but it is generally considered to be an extract from the bark of Strychnos toxifera and other species of Strychnos. It is brought from the banks of the Orinoco, and occurs in the form of dark-brown or grayish lumps or powder, soluble in water, of an intensely bitter taste, and, when triturated, of a powerful odor. An alkaloid termed *curarine* ($C_{18}H_{35}N$) has been extracted from woorara, which is said to exist as a sulphate (Sachs). Recently (1886) another alkaloid termed *curine* has been discovered by Böhm.

INCOMPATIBLES.—The caustic alkalies and tannin decompose the alkaloids.

AIDS.—The depresso-motors, as physostigma and conium.

PHYSIOLOGICAL EFFECTS.—Woorara, *topically* applied, is an irritant. It is ranked with the motor-depressants, and is considered to destroy life by paralysis, more or less rapid, of the respiratory muscles. A peculiarity of its action is that it is comparatively innocuous when taken by the stomach, being either not absorbed at all in this viscus, or so slowly as to allow of its elimination by the kidneys before dangerous accumulation in the blood. According to Lauder Brunton, on introduction into the stomach the absence of poisonous effects of curare is due, probably, to its being passed round the entero-hepatic circulation. Hence, for therapeutic purposes, it must be employed either endermically to a blistered surface or by hypodermic injection. Woorara paralyzes the intra-muscular motor-nerve endings without affecting the muscular irritability, and destroys the reflex function of the spinal cord: in other words, the paralysis induced by it is peripheral and not centric; eventually, however, the paralyzing action of woorara extends to the nerve-trunks and centres. The cerebrum is only secondarily involved. Woorara stimulates and then paralyzes the accelerator cardiac nerves. Other effects of woorara are elevation of temperature, increased nasal, salivary and intestinal secretions, and diabetic urine (in animals). The elimination of curarine has been distinctly shown to take place, in part, by the kidneys. Artificial respiration retards the poisonous effects of the drug; also the tetanizers, and chloral to a certain extent.

MEDICINAL USES.—Woorara, or curarine, is only applicable to the treatment of those affections which therapeutically require motor-depressants to antagonize the disease process. Among the most prominent of these are *tetanus* and *hydrophobia*. In tetanus good results have been obtained from its use in large doses, while from hydrophobia there are two reported cases of recovery. It has also been employed in *chorea*, *epilepsy*, and *paralysis agitans*. The dose of woorara is from $\frac{1}{10}$ to $\frac{1}{5}$ of a grain. Of *curarine*, from gr. $\frac{1}{200}$ to $\frac{1}{100}$, hypodermically. Caution must be enjoined, as the samples vary.

VIBURNUM.

Viburnum is the BARK of Viburnum prunifolium, commonly known as the Sloe or Black Haw (*Nat. Ord.* Caprifoliaceæ), a small tree growing in thickets in the Southern and Western States, with opposite, oval, obovate, sharply serrulate leaves about two inches long, and short, slightly marginal petioles. It has small white flowers in terminal cymes, appearing in May; and small blue-black edible drupes containing a flattish, smooth putamen. The bark is in thin pieces or quills of a purplish-brown color, with scattered warts and minute black dots; collected from the old wood it is a grayish-brown, the thin corky layer easily removed from the green layer; the inner surface is whitish and smooth; it breaks with a short fracture; is without smell, and of a bitter, astringent taste (Stillé and Maisch; Maisch). It contains *valerianic acid*, a brown bitter *resin*, a greenish-yellow *bitter-principle* (*viburnin*), *tannin*, etc.

INCOMPATIBLES.—As it contains tannin it is incompatible with the substances precipitated by this agent.

EFFECTS AND USES.—The physiological effects of viburnum are not understood. It probably acts as a sedative to the spinal centres, especially those governing the uterine functions; but whether it influences the circulation or the blood-supply to the uterus, or what action, if any, it has on the sympathetic ganglionic system are questions for the future to determine. It is said that no disagreeable after-effects attend its use.

Viburnum has been administered as a sedative in cases of threatened *abortion*,* whether accidental or due to the action of drugs, and it is said to be especially serviceable where a tendency to abortion exists from habit. In these cases ʒj may be given every two or three hours as long as the abortion is threatening. It is also recommended to allay the severity of *after-pains*, and is one of the numerous remedies which have been used for the relief of the *vom-*

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* *Liverpool Med. and Surg. Journal*, 1875, p. 41, J. H. Wilson.

iting of pregnancy. It has also been employed with success in *menorrhagia* and *metrorrhagia*, depending on anemia, debility or other systemic cause, and in menorrhagia accompanied with nervous symptoms appearing at the climacteric period. It has been given, too, in *dysmenorrhœa*[*] with profuse discharge, accompanied by a feeling of weight in the pelvis, and may be combined with other remedies in the treatment of neuralgic dysmenorrhœa. The *fluid extract* is official, the dose of which is f℥ss-j.

GRINDELIA.

Grindelia is the LEAVES and FLOWERING TOPS of the Grindelia robusta (*Nat. Ord.* Compositæ), an herbaceous perennial plant growing to the height of one or two feet, indigenous to the Pacific coast. It resembles the common sunflower in its general appearance, and contains *vegetable wax*, *fixed* and *volatile oils*, a *greenish, soft, acid resin* having the odor of the drug, an acid *saponin-like body* (grindelin), a trace of tannin, but no alkaloid (W. H. Clark[†]).

INCOMPATIBLES.—The volatile oils and resin of grindelia are not miscible with preparations containing water.

AIDS.—The depresso-motors.

PHYSIOLOGICAL EFFECTS.—In large doses, grindelia exerts a decided hypnotic effect, during which the pupils are dilated and reflex action, motion, and sensation are depressed. Buffington's[‡] investigations give the following results: the cardiac action is slowed by grindelia, through stimulation of its inhibitory centre, while the local blood-pressure is raised. The statement as to the slowing of the heart and reduction of blood-pressure are confirmed by Dobroklonsky.[§] The respiratory movements are increased in frequency by an action of the drug on that centre. It is eliminated by the kidneys, inducing a marked increase in the urinary flow and to a certain extent by the lungs. The statement in regard to its diuretic action is not confirmed by Dobroklonsky (*loc. cit.*), who affirms that it is feebler in this respect than digitalis. Grindelia is not actively *toxic*, though a lethal dose will destroy life by arrest of respiration. Its poisonous effects are counteracted by the spinal excitants, strychnia for example.

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[*] "New Preparations," 1879, p. 137.

[†] *American Jour. of Pharmacy*, Sept., 1888.

[‡] *Am. Journ. Med. Sci.*, Jan., 1886.

[§] Thèse de St. Petersburg. Quoted by *Bull. Gén. de Thérap.*, CXI, 277.

MEDICINAL USES.—Grindelia is very serviceable in the treatment of *asthma*, especially in the uncomplicated spasmodic form, but it has also proved useful when this disease is complicated with bronchitis. In many cases of *hay-asthma* and *hay-fever* it has proved of much benefit. It is useful in *whooping-cough*, and is also recommended in *acute* and *chronic bronchitis* and *pneumonia*. Dr. H. M. Fiske recommends its internal and local use in *iritis*. It has been used as an injection in *vaginitis* and as a local application in *poisoning* by rhus toxicodendron, the latter with varying results. The *fluid extract* is official, the dose of which is ♏x–fʒj.

SUMBUL.

Sumbul is the ROOT of the Ferula Sumbul (*Nat. Ord.* Umbelliferæ), a perennial plant, growing to the height of eight feet, with large triangular, tripinnate radical leaves and a few small cauline leaves. It is a native of Turkestan and eastern Siberia. The root reaches us through Russia, and is met with in transverse slices from one to five inches in diameter and three-quarters to two inches thick. It is light, spongy, annulated, with a thin brownish bark and a whitish interior, with numerous dots of brown-yellow resin and irregular, easily separated fibres; of a strong musk-like odor and a bitter balsamic taste. The root of the Dorema ammoniacum is sometimes flavored with sumbul, but may be distinguished from it by being firmer, denser, and of a yellow or reddish tint (Stillé and Maisch).

CHEMICAL CONSTITUENTS.—Sumbul root contains a *volatile oil*, a soft *resin*, *angelic* and *valerianic acids* (Maisch). The soft oleoresin is soluble in ether, exists in the proportion of 9 to 100, and imparts to water the odor of musk (Remsch).*

EFFECTS AND USES.—The physiological effects of sumbul are not accurately known. It probably acts as a sedative to the brain and spinal cord. It was originally introduced into Russia as a remedy for cholera, and is still used there in asthenic dysentery and diarrhœa. In England it has been used in *dysmenorrhœa*, *hysteria*, *epilepsy*, and various allied nervous disorders. Mr. Murawieff recommends it in *chronic bronchitis* in old and debilitated patients, in humid *asthma* and *hysteria*, and Phillips has seen it prove useful in *chronic bronchitis*. He also recommends it in severe cases of facial, sciatic, or ovarian *neuralgia*. Boehm (Ziemssen's *Cyclopædia*) speaks favorably of it in *delirium tremens*. It is not much used in this country. The *tincture* may be given in doses of ♏x–f℥j.

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* *Journ. de Pharm. et de Chimie*, 4ième ser., 1871, p. 320.

CLASS II.—ECCRITICS.

ORDER I.—EMETICS.

Emetics (from 'εμέω, I vomit) are medicines which are employed to promote vomiting; when they are used merely to excite nausea, they are termed *nauseants*. When an emetic is administered, usually within fifteen or twenty minutes afterward a feeling of distress, relaxation and faintness is experienced, with coolness and moisture of the skin and a small, feeble, irregular pulse. These symptoms increase till the contents of the stomach are ejected. During the act of vomiting, the face becomes flushed, the pulse is full and frequent, and the temperature of the body is increased. After vomiting is over, the skin is moist, the pulse soft and feeble, the patient becomes languid and drowsy, and, under peculiar circumstances, alarming and even fatal syncope has been induced. Emetics act either *directly* on the centres of the medulla which govern the act of vomiting, or by the *local* irritation they produce, which, being conveyed to the centre by filaments of the pneumogastric nerve, produces vomiting in a reflex manner. In the former case, vomiting is produced by the drug, no matter in what manner it enters the system, and it is therefore called a *systemetic emetic;* in the latter, vomiting is only produced by the introduction of the substance into the stomach, and it is hence called a *local emetic*. Some agents, however, act in both ways, as copper sulphate. Reflex vomiting may be excited by irritating the fauces, as with a finger or feather. Dr. Marshall Hall gives the following summary of the mechanism of vomiting: "During the act of vomiting, 1, the larynx is closed; 2, the cardia is opened; and 3, all the muscles of expiration are called into action; but, 4, actual expiration being prevented by the closure of the larynx, the force of the effort is expended upon the stomach, the cardia being open, and vomiting is effected."

Susceptibility to the action of emetics differs in different individuals and in different diseases. In fevers, and where gastric irritation is present, their influence is increased; and, on the other hand, when the brain is oppressed by disease or by narcotic medicines, the stomach is exceedingly insensible to their action. Children vomit more readily than adults, because the stomach of a child has no fundus.

MEDICINAL USES.—Emetics are employed therapeutically—1, to evacuate the stomach, for the purpose of removing poisons, undigested food, etc.; and, with this view, the emetics should be selected which occasion least nausea and distress; 2, to expel foreign bodies lodged in the throat or œsophagus; 3, to excite nausea, and thereby depress the vascular and muscular systems, thus acting as anaphrodisiacs; 4, to relieve spasm, as in *spasmodic croup*, *hiccough*, *laryngysmus stridulus*, and *convulsions*; 5, to promote secretion and excretion, etc.; and 6, sometimes to break up a train of morbid associations, by giving a shock to the system, as in the forming stages of certain fevers, as *typhus* and *scarlatina*, and of *delirium tremens*.

CONTRAINDICATIONS.—They are improper where the effort of vomiting is liable to increase any existing pathological conditions, as in congestion of the brain, pregnancy, hernia, etc., or where such debility is present that the depressing effects might prove fatal, as in the last stages of membranous croup.

The act of emesis is promoted by the free use of tepid drinks; excessive vomiting may be checked by demulcents, opiates, counter-irritation to the stomach, etc.

VEGETABLE EMETICS.

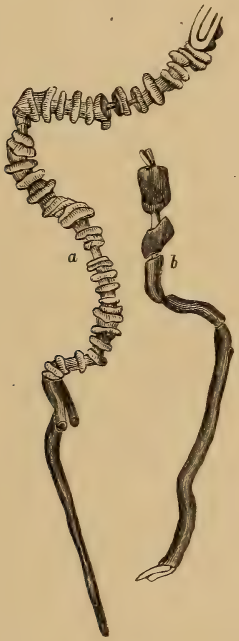
IPECACUANHA–IPECAC.

Ipecacuanaha is the ROOT of Cephaëlis Ipecacuanha (*Nat. Ord.* Rubiaceæ), a small shrubby perennial plant of Brazil, where it grows to the height of about five or six inches.

DESCRIPTION.—The roots, as met with in the shops, are in pieces about the size of a quill several inches long of an irregular, twisted, contorted shape, with numerous circular rings or rugæ, from which they have been termed *annulated*. When broken, they are seen to consist of two distinct parts—a thin ligneous axis or centre, which is nearly inert, and a thick, cortical layer, which has an herbaceous, acrid, rather bitter taste and a slightly nauseous odor. A distinction is made of *black*, *red* and *gray* ipecacuanha, from differences in the color of the epidermis; but they are all derived from the same plant, and are the same in properties and composition. The *black* is the most common variety in our market. The powder is of a light grayish-fawn color, and has a peculiar nauseous odor, which in some persons excites violent sneezing, in others, dyspnœa. Ipecacuanha imparts its virtues to both water and alcohol, but they are injured by decoction.

Chemical Constituents.—Its emetic property depends on the presence of an alkaloid, termed *emetine* ($C_{30}H_{40}N_2O_5$) (Kunz *), which exists in connection with *ipecacuanhic acid*. Emetine is a whitish, inodorous, slightly bitter substance, sparingly soluble in water and ether, and very soluble in concentrated alcohol and chloroform. It produces vomiting in the dose of gr. ¼, and in overdoses may occasion dangerous and even fatal symptoms. Occasionally a sophisticated root, that of *Psychotria emetica*, derived from New Granada, is found in the markets; this is not *annulated*, but longitudinally *striated*, and contains less than half the quantity of the emetine found in the genuine root (1½ per cent.).

Fig. 30.



CEPHAËLIS IPECACUANHA; *a*, *b*, ROOT; *a*, ANNULATED PORTION.

Incompatibles.—Tannic acid, the astringent infusions, caustic alkalies, and metallic salts.

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* *Arch. der Pharmacie*, 1887, p. 461.

AIDS.—The emetics, as apomorphia, also warm diluents.

PHYSIOLOGICAL EFFECTS.—*Locally*, powdered ipecac is an irritant to raw surfaces and to the mucous membranes, causing violent sneezing, etc. When rubbed into the sound skin it causes pustulation and even ulceration. Nervous system: it stimulates the centre of the medulla oblongata which presides over the act of vomiting, and somewhat diminishes the reflex activity of the cord. The following observers, viz.: D'Ornellas,* Phillips,† and Duckworth,‡ ascertained that emetine, in animals, always caused vomiting, given either by the stomach or subcutaneously. D'Ornellas (*loc. cit.*) and Duckworth (*loc. cit.*) found, too, that when the vagi were divided in the neck the alkaloid was powerless as an emetic. Toxic doses (in animals) generally destroy life by paralyzing the respiratory centres, the nerves probably remaining unaffected. Circulation: moderate doses probably do not affect the circulation; very large doses injected into the jugular vein of dogs have killed by cardiac paralysis. Temperature: in the mouth and on the surface the temperature falls in cases of emetine poisoning, but in the intestines it rises (from the irritant action of the poison). Secretion: repeated small doses relax the skin and increase the perspiration, saliva and the bronchial and gastric mucus. Rutherford states that it has the power of stimulating the secreting apparatus of the liver (in dogs), and that the consequent augmented secretion of bile is normal in composition as regards the biliary matters proper. It also increases the secretion of intestinal mucus. Gastro-intestinal tract: it is an irritant to the stomach, producing vomiting by *local irritation* as well as by *direct action* on the medulla. Elimination takes place by the gastro-intestinal mucous membrane, and also by other secretions.

MEDICINAL USES.—In full doses, ipecacuanha is a mild and certain emetic, well adapted to the treatment of spasmodic *croup* and *acute bronchitis* in children, and to all cases where a simple evacuation of the stomach is desired. In smaller doses it produces nausea, depression of the pulse, expectoration and diaphoresis, and with these views it is employed in the treatment of pulmonary affections, as *acute bronchitis;* also in *acute dysentery*, and inflammatory disorder generally. In still smaller doses it is useful as a tonic and stomachic. At the onset of *yellow fever* an ipecacuanha emetic followed by a full dose of quinine may be given.

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* *Bull. Gén. de Thérap.*, LXXXIV, pp. 193, 244, 348: Du Vomissement, etc.

† *Practitioner*, London, III, p. 276. "On the action and uses of ipecacuanha."

‡ *Ibid.*, Vol. V. p. 218, and Vol. VII, p. 91. "Observations upon the action of ipecacuanha," etc.

Ipecacuanha was first introduced as a remedy in *dysentery*, and, after being for a time laid aside, has been again taken up with marked success. It is particularly of value in epidemic dysentery, and in India is used in very large doses in this affection, as much as ʒij being sometimes given every few hours. Good effects often follow its use in acute dysentery of sporadic kind, especially when occurring in puerperal women, given in doses of gr. xv–xx combined with opium every three or four hours. If no effect is produced by the ipecac-treatment of dysentery in two days, it is best to abandon it. It is also used with advantage in the vomiting of *sick headache*, and will sometimes, when given in small doses, frequently repeated, arrest the nausea and even the *vomiting of pregnancy* (Fuller *). The wine or fluid extract (in drop doses) is best for this purpose. Given in pills containing gr. ¼–¾ before meals, it is of service in *dyspepsia* accompanied by deficiency of gastric and biliary secretions. As it stimulates the secretory apparatus of the stomach and liver, the rationale is obvious.

Administration.—Dose, as an *emetic*, gr. xv–xx; as a *nauseant*, gr. ss–ij, three or four times a day; as an *expectorant* or *diaphoretic*, gr. ¼–½, repeated; as a *tonic*, gr. $\frac{1}{10}$, repeated. The *fluid extract* is used as an addendum to expectorant and diaphoretic mixtures, and in *bronchitis* is advantageously combined with the syrup of wild cherry and morphine. As an emetic, the dose is f℥ss–j; the *wine* (*vinum ipecacuanhæ*) contains fluid extract 7 parts in stronger white wine 93 parts; dose, as an emetic, f℥ss–j; *fluid extract*, 5 parts, mixed with simple *syrup*, 95 parts, makes *syrupus ipecacuanhæ*, an excellent preparation for children—f℥j containing gr. xxx of ipecacuanha; for a child a year or two old, fʒss–j may be given as an *emetic*, and gtt. x–xx as an *expectorant*. *Pulvis ipecacuanhæ et opii* (formerly called *pulvis ipecacuanhæ compositus*, or *Dover's powder*) contains powdered ipecac and opium each gr. j, sugar of milk gr. viij (see p. 89); a *tincture of ipecac and opium* is also official (see p. 89). *Troches of ipecacuanha* (contain also sugar, tragacanth, and syrup of orange-peel), each troche contains ipecac gr. ¼. *Troches of morphine and ipecac* each contain morphine sulphate gr. $\frac{1}{40}$, ipecac gr. $\frac{1}{12}$, with sugar, oil of gaultheria and mucilage of tragacanth.

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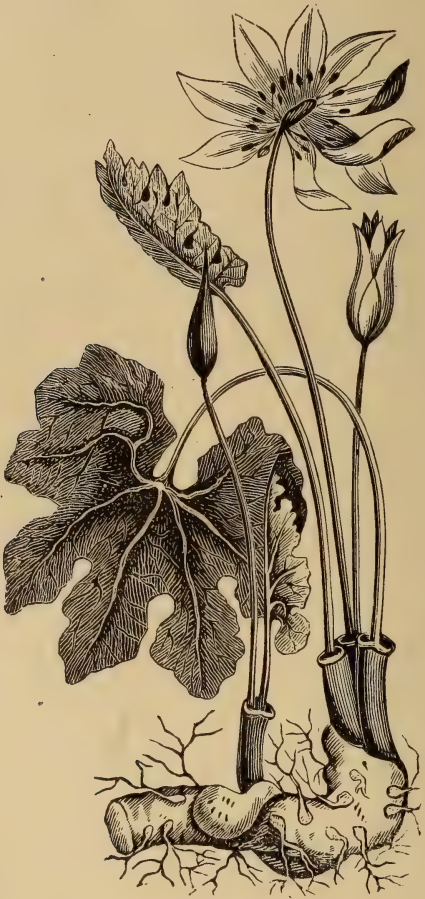
* *Lancet*, London, Dec. 4th, 1869, p. 268.

SANGUINARIA.

The RHIZOME of Sanguinaria canadensis, or Bloodroot (*Nat. Ord.* Papaveraceæ), a small indigenous plant, with radical, lobate reniform leaves and a handsome white eight-petaled flower, which appears in early spring, is usually classed with emetics. When dried it comes in flattened pieces, much wrinkled and contorted, of a reddish-brown color, with a faint narcotic odor and a bitterish very

FIG. 31.



SANGUINARIA CANADENSIS.

acrid taste. It yields its virtues to water and alcohol, and loses them very rapidly by keeping. An alkaloid, *sanguinarine* ($C_{19}H_{17}NO_4$), has been obtained from it which possesses the properties of the root.

Incompatibles.—The alkalies, tannic acid and metallic salts.

Aids.—The vegetable and mineral emetics.

Physiological Effects.—*Locally*, it acts as an irritant, and upon fungous surfaces, as an escharotic. Bloodroot is an acrid emetic, and, in large doses, an acro-narcotic poison. When inhaled, the powder causes violent sneezing. Bloodroot has a persistent, bitter taste, and in passing to the stomach leaves a feeling of constriction about the throat. In large doses it causes collapse, dilated pupil, and sometimes convulsions of spinal origin, and it diminishes reflex activity. After nauseating doses the pulse and arterial pressure are increased, but when enough is taken to produce vomiting the pulse is slow and irregular and the arterial tension is lowered. After poisonous doses the respiration becomes shallow and slower, and death takes place from asphyxia, due to paralysis of the respiratory centre.

Sanguinaria* produces salivation and increases the secretion of the gastric mucous membrane. It stimulates the liver and intestinal glands, increasing the secretion of bile, but at the same time rendering it more watery (Rutherford). It is an active *systemic emetic*, causing much depression and irritation of the mucous membrane.

Medicinal Uses.—It is not much employed as an emetic, but is occasionally exhibited with this view in *croup* and *diphtheria*, or as an expectorant in *pulmonary affections*. In *duodenal catarrh* and *catarrhal jaundice* it has been used with advantage. It has also been prescribed as an emmenagogue in *amenorrhœa*. Dose, as an *emetic*, gr. x–xx, in pill. *Tincture*—dose as an *emetic*, fʒiij or iv; as an *expectorant*, ♏v–xxx. The *vinegar* (*acetum*) contains ten per cent. by weight of the powdered drug. The *fluid extract* should be used with care, as it is a powerful preparation; dose, as a *nauseant*, ♏ij–v; as an *emetic*, ♏xv–fʒ.

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* For the details of a complete investigation of the action of Sanguinaria consult *Am. J. M. Sci.*, Oct., 1876, p. 346, by R. M. Smith, M. D.

APOMORPHINÆ HYDROCHLORAS—APOMORPHINE HYDROCHLORATE.

Apomorphine ($C_{17}H_{17}NO_2$) is an artificial alkaloidal substance obtained by heating morphine or codeine with hydrochloric acid under pressure, the acid subtracting one molecule of water from a molecule of morphine, and leaving apomorphine ($C_{17}H_{19}NO_3 = H_2O + C_{17}H_{17}NO_2$). When apomorphine is treated with hydrochloric acid it combines to form the official salt. When pure it is a white powder, but it absorbs moisture readily, becoming green, which change, however, is said not to impair its therapeutic properties.

Physiological Effects.—Given to animals in large doses, it at first stimulates the nerve-centres and afterward paralyzes them. Convulsions are produced, but their origin is not precisely determined, and it is a poison to the muscular system.* Small doses increase the cardiac action and elevate the blood-pressure, but when large doses are taken, the cardiac movements are probably slowed and the pressure diminished. According to Reichart (*loc. cit.*), it quickens the heart's beats by stimulation of its accelerator fibres, and slows it by a direct repressing influence on its muscular substance. Very large doses may have a decided sedative action on the circulation (in man), and even induce syncope. Large doses at first increase the number of the respiratory movements, but afterward diminish them. A poisonous dose destroys life by asphyxia, death being due to the action of the drug on the respiratory centre. Apomorphine is chiefly of interest therapeutically on account of the emesis which follows its administration, to which attention was first called, we believe, by Dr. S. J. Gee.† It is a prompt and efficient *systemic emetic*, causing vomiting within a half hour after it is taken, which is repeated two or three times at intervals of about fifteen minutes, and is attended by slight nausea and usually little or no depression.

Medicinal Uses.—Apomorphine may be used as an emetic hypodermically or by the stomach, in cases of *narcotic poisoning* or where it is desirable to evacuate the contents of the stomach promptly. It has also been used as an expectorant in both *acute* and *chronic bronchitis*, and in the *capillary bronchitis* of infants. Trousseau recommends it in *hemoptysis*. Dose of the *hydrochlorate*, (the same as that of the pure drug), gr. $\frac{1}{16}$ hypodermically, or $\frac{1}{8}$ or perhaps $\frac{1}{4}$ by the stomach. It should be given cautiously, on account of the depression which occasionally accompanies its action.

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* *Phila. Med. Times*, Dec., 1879, E. T. Reichert. "Physiolog. Action of Apomorphine hydrochlorate."

† *St. Barthol. Hosp. Reports*, v, 215.

Sinapis (*Mustard*). The POWDERED SEED of Sinapis nigra and Sinapis alba (*Nat. Ord.* Cruciferæ), in doses of from a teaspoonful to a tablespoonful, are very useful emetics, particularly in atonic conditions of the stomach.

Tobacco and Lobelia act as emetics in large doses, but their employment is attended with danger, owing to the great prostration which they produce (see pp. 301; 304). Squill also possesses emetic powers, but it is too irritating for use in this respect.

MINERAL EMETICS.

Tartar Emetic. Dose, gr. j–ij (see p. 251).
Zinc Sulphate. Dose, gr. x–xx (see p. 204).
Copper Sulphate. Dose, gr. iij–v (see p. 203).
Alum. Dose, a teaspoonful (see p. 211).
Yellow Mercurial Subsulphate or Turpeth Mineral. Dose, gr. ij-v (see Mercuric Preparations).

ORDER II.——CATHARTICS.

Cathartics (from *καθαίρω*, I purge) also *purgatives*, are medicines which produce evacuations from the bowels. Some operate by increasing the peristaltic motion of the intestines; others stimulate the mucous follicles and exhalants, and occasion watery evacuations, whence they are termed *hydragogues*. The more violent of the hydragogues, if given in overdoses, produce inflammation of the alimentary canal, characterized by violent vomiting and purging, abdominal pain and tenderness, cold extremities and sinking pulse. From their activity they are denominated *drastics*. Different cathartics affect different parts of the alimentary canal unequally, some acting more particularly on the upper portion, some on the lower, and others affecting all parts equally.

Cathartics may be arranged in five groups: 1. *Laxatives*, which gently evacuate the contents of the bowels, without causing any obvious irritation or affecting the general system. 2. *Saline cathartics*, which increase both the peristaltic action of the bowels and the effusion of fluids from the mucous surface, but are devoid of any excitant action on the general system, and are therefore adapted to the treatment of febrile and inflammatory cases, or where, from any cause, it is desirable to deplete the vessels of the intestines by the abstraction of water. 3. *Mild acrid carthartics*, which are acrid, but not sufficiently violent in their local action to cause inflammation. 4. *Drastics*, comprising the more powerful and irritating cathartics, which, in large doses, act as acrid poisons. 5. *Mercurial cathartics.*

Cathartics are employed *therapeutically*—1. To evacuate the bowels in constipation, and remove noxious matters, as retained feces, undigested food, morbid secretions, worms, poison, etc. 2. To depurate the blood, as in typhus fever, uremia, etc. 3. To relieve inflammation, congestion and plethora, by the depletion of the blood-vessels, which results from increased secretion and exhalation from the gastro-intestinal canal. 4. To promote absorption. 5. To affect remote organs, particularly the brain, through the agency of revulsion and counter-irritation. 6. To stimulate the secretion of the liver and pancreas, by irritating the orifice of the ductus communis choledochus. 7. In the treatment of diarrhœa. 8. To relieve spasms of the bowels. 9. To restore the catamenia, by the irritating influence which they exert on the pelvic vessels. The more active cathartics are *contraindicated* in cases of inflammation or ulceration of the gastro-intestinal mucous membrane, peritonitis, the advanced stages of typhoid fever, pregnancy, etc.

The operation of cathartics is promoted by the addition of small doses of emetics and of the bitters. By combining those which act upon different portions of the alimentary canal, their operation is rendered less irritant, without any diminution of purgative efficiency. The griping and nauseating tendency of the drastic cathartics may be corrected by the addition of aromatics; carbonic acid water is a grateful vehicle for administering the saline preparations. Cathartics operate most speedily and favorably when given on an empty stomach, and susceptibility to their action is diminished during sleep, and increased by exercise. Mild diluent beverages promote their operation. In the event of hypercatharsis, opium should be admministered by the mouth or the rectum.

LAXATIVES.

Several articles of diet have a laxative operation on the bowels, and are useful in cases of habitual costiveness, as most of the ripe and dried fruits—particularly the tamarind, peach, apple, raisin, fig (*ficus*), and prune (*prunum*)—West India molasses, honey, bran, cracked wheat, Indian meal, and oatmeal.

The following medicinal substances are usually arranged under the head of *laxatives*, and are employed in cases where we wish to open the bowels with the least possible irritation,—as in children and pregnant women, in inflammation or surgical operations about the abdomen and pelvis, in typhoid fever, hernia, piles, and affections of the rectum or womb.

TAMARINDUS—TAMARIND.

This is the PRESERVED PULP OF THE FRUIT of Tamarindus Indica (*Nat. Ord.* Leguminosæ), a large tree of the East Indies, cultivated extensively also in the tropical portions of America. It comes to the United States chiefly from the West Indies. The preserved pods, as found in the shops, consist of a dark-colored adhesive mass, formed of pulp, fragments of the pods, seeds and syrup, of a sweetish acidulous taste. They contain a good deal of *citric acid*, with some *tartaric* and a little *malic acid*. An infusion of the pulp sweetened, makes a refrigerant and laxative drink ; ℥ss–j of the pulp is a good laxative. It enters into the *confection of senna*.

MANNA.

Manna is the CONCRETE SACCHARINE EXUDATION, in *flakes*, of Fraxinus Ornus and of Fraxinus rotundifolia (*Nat. Ord.* Oleaceæ), small trees of Sicily and southern Italy.

PREPARATION AND DESCRIPTION.—It is obtained from incisions into the stems of the trees. The best kind is produced during the height of the season, when the juice flows vigorously, and from the upper stems, where it is less fatty. It is called *flake-manna*, or *manna cannulata*, and consists of pieces from one to six inches long, one to two inches wide, and from half an inch to an inch thick, of irregular form, but more or less stalactitic, hollowed out on one side (from the shape of the tree or substance on which they are concreted), of a white or yellowish-white color, an odor like that of honey, and a sweet, afterward rather acrid, taste. A common manna, called *common manna*, or *manna in sorts*, is obtained from incisions later in the season, and from the lower stems. It occurs in small pieces, which seldom exceed an inch in length, and are softer, more viscid and dark than the flake-manna. A still inferior variety is termed *fat manna*, and consists of small, soft, viscid fragments, of a dirty, yellowish-brown color mixed with a few pieces of flake-manna.

Chemical Constituents.—Manna is soluble in both water and alcohol, and contains a white crystalline, saccharine principle, termed *mannit* ($C_6H_{14}O_6$), not susceptible of the alcoholic fermentation (found also in mushrooms, the olive-tree and other plants), *fraxin* ($C_{32}H_{36}O_{20}$), some *sugar*, and a *resin* to which it probably owes most of its purgative effect.

Effects and Uses.—In moderate doses manna is nutritive; in larger, *mildly laxative*. It is given principally to children in *constipation*, to whom its sweet taste renders it acceptable; and it is sometimes combined with the more active cathartics. It may be taken in substance, or dissolved in warm milk or water. Dose for an adult, ℥j–iij; for children, ʒj–iij.

VIOLA TRICOLOR.

Viola tricolor is the wild-grown flowering herb of Viola tricolor, Heartsease or Pansy (*Nat. Ord.* Violaceæ), an annual or biennial herb, native of Europe and northern Asia, naturalized in the United States and cultivated in our gardens. The stem is nearly smooth, and grows to the height of one-half to one foot; the leaves are alternate, petiolate, ovate or oblong, crenate, and have prominent pinnatifid stipules. The flowers are on long peduncles, and have the corolla partly yellowish-blue and purple. It is without smell, and has a bitter, sub-acrid taste. It contains *mucilage*, *sugar*, *salicylic acid*, a *bitter-principle*, *resin*, etc.

Effects and Uses.—Heartsease is a *mild laxative*, sometimes proving diuretic and diaphoretic. It is occasionally given as a mild laxative to children, but its use is generally restricted to cases of *acute eczema*, and *phthiriasis*. In these cases it is said to act almost like a specific. Piffard* who has used it extensively, recommends an infusion (V. tricolor, ℥j; senna leaves, ℥ss; boiling water, Oij), of which a tumblerful may be given twice a day for two or three days, after which the dose should be diminished. He finds it particularly serviceable in the second stage of eczema, with sero-purulent exudation and crusting. The fluid extract (Squibb's) may also be given; in acute eczema, dose for a child, ♏j–v once or twice daily; in *chronic eczema*, ♏x–xv; for an adult the dose is fʒss–j. It should be taken in water, half an hour before meals. Sometimes it temporarily increases the severity of the eczema, and in these cases it should be discontinued for a day or two, or the dose may be lessened.

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* "Materia Med. and Therap. of the Skin," 1881, p. 115.

CASSIA FISTULA.

This is the FRUIT of Cassia Fistula or Purging Cassia (*Nat. Ord.* Leguminosæ), a large tree of Egypt and the East Indies, now naturalized in the West Indies and South America. It consists of long, woody, dark-brown pods, about an inch in diameter and nearly two feet in length, which contain numerous seeds imbedded in a soft black pulp. The PULP is the part used, and has a faint nauseous odor and a sweet, rather pleasant, mucilaginous taste. It is, in small doses, a *mild*, agreeable laxative, but its chief use is as an ingredient in the *confection of senna*. Dose, ʒj to ℥j.

Oleum Olivæ (*Olive-Oil*). The well-known FIXED OIL obtained from the FRUIT of Olea europæa, or Olive Tree (*Nat. Ord.* Oleaceæ), is nutritive, demulcent, emollient, and laxative. It is frequently prescribed as a constituent of laxative enemata. It is also used as an inunction in *measles* and *scarlet fever*.

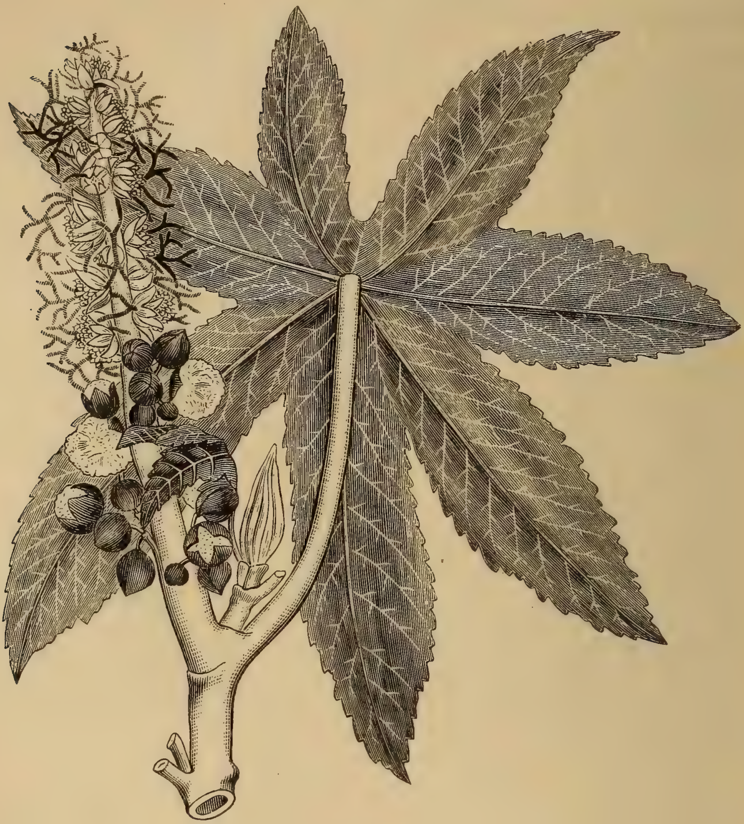
Oleum Amygdalæ Expressum (*Expressed Oil of Almond*), a fixed oil expressed from the Sweet or Bitter Almond, is used for the same purposes as olive-oil.

OLEUM RICINI—CASTOR OIL.

Castor-oil is the FIXED OIL obtained from the SEED of Ricinus communis, or Palma Christi (*Nat. Ord.* Euphorbiaceæ), a small perennial tree of India, now naturalized in many warm climates, and cultivated extensively in the United States. In India it attains a height of thirty or forty feet, but in this country it is an annual plant, about five or six feet in height, with round, thick-jointed, furrowed stems, of a purplish color above; large peltato-palmate leaves, divided into seven or nine segments, on long round footstalks, and prickly, three-celled capsules, with a seed in each cell. The seeds are ovate, about the size of a small bean, and of a gray color, marbled with reddish-brown spots and stripes. They consist of a thin outer pellicle, an inner hard, blackish shell—both of which are inert—and a white oleaginous *kernel*, which contains the acrid principle.

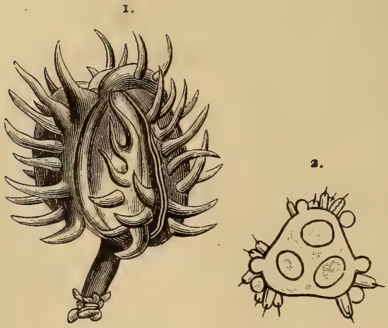
PREPARATION AND CHEMICAL CONSTITUENTS.—Castor-oil is obtained by expression, by decoction, and by the agency of alcohol.

FIG. 32.



CASTOR-OIL PLANT.

FIG. 33.



1. Castor-Oil Capsule.
2. Section of Capsule Showing Seeds.

The first method is the best, and is that which is pursued in this country, where large quantities are made, both for home consumption and exportation; heat should not be employed in preparing it, as it renders it rancid. Thus procured, it is nearly colorless, or of a pale-yellow color, of a thick, viscid consistence, a faint, unpleasant odor, and a mild, nauseous taste, and becomes rancid and thick by exposure to the air. It is not soluble in water, but is extremely soluble in alcohol, readily so in ether, and forms soaps with the alkalies. Its composition is not well understood; its constituents would seem to be mainly *ricinolein* (a saponifiable oil resembling olein), *ricinic acid*, *palmitin*, and an *acrid principle*. A recent analysis of the stem, root and leaves by Beck[*] yielded volatile oil (non-saponifiable), wax, resin, alkalies, and an alkaloid termed *ricinine* ($C_{24}H_{32}N_7O_3$), identical with the alkaloid obtained by Tuson from the seed, and with the substance extracted by Wayne,[†] from the leaves. The latter denies its claim to being called an alkaloid.

TOXICOLOGY.—The kernels possess considerable acridity, and in large quantities have produced death—the usual symptoms being vomiting and purging—and Taylor[‡] records a case in which the eating of twenty of the seeds killed a girl. Christison[§] states that the seeds will operate as a violent cathartic. Dr. Edson[||] has, however, recently reported sixteen cases of non-fatal poisoning following the ingestion of the bean, in none of which did catharsis occur. In each instance it was thought three or four were eaten.

EFFECTS AND USES.—Castor oil is a *mild* and tolerably certain laxative in *constipation*, operating, when pure, in from four to six hours after its administration, without uneasiness in the bowels. It does not stimulate the liver nor increase the secretion of bile, but purges by a mild irritant action on the intestines (Rutherford[¶]). It is admirably adapted to all cases where a free evacuation of the bowels is desired, without abdominal irritation, as in *acute dysentery*, *pregnancy*, *typhoid fever*, *cholera infantum*, *intestinal colic*, *enteritis*, *hemorrhoids*, *proctitis*, *yellow fever*, *peritonitis*, etc., and is an excellent purgative for children. In dysentery or in *diarrhœa* due to the indigestion of unripe fruit, great benefit is often derived from an emulsion of oil with laudanum: ℞ Tincturæ opii, fʒj; olei ricini, f℥jss; pulveris acaciæ, ʒij; sacchari albi, ℥ss; aquæ cinnamomi, *q.s.* ad f℥iij. M. et Sig.—Shake the bottle and take two teaspoonfuls every four hours. A similar prescription, modified according to age, will be found of service in the summer diarrhœas of children. The *leaves* are said to possess *galactagogue* properties, and are applied to the breasts, in the form of decoction, to induce the secretion of milk.

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[*] *Am. Journ. of Pharmacy*, Feb., 1888, p. 93. "Analysis of Ricinus Communis."

[†] *Ibid.*, 1874, p. 97.

[‡] Manual of Med. Jurisprudence, p. 224.

[§] "A Treatise on Poisons," 4th ed., p. 590.

[||] *Brooklyn Med. Journ.*, Feb., 1888, p. 131.

[¶] "Phys. Action of Drugs on Secretion of Bile." 1880.

Administration.—For adults the dose is f℥ss–j; for children, fʒi–f℥ss. To cover its unpleasant flavor it is sometimes taken floating on spirit, coffee, mint-water, compound spirit of ether, etc., or made into an emulsion, or mixed with the froth of porter or a little oil of bitter almond.

Flaxseed Oil and Melted Butter are laxative in the same doses as castor-oil.

SULPHUR.

Sulphur exists in both kingdoms of nature. It is procured by the purification of native sulphur and by the decomposition of the native sulphides. The sulphur of commerce is generally obtained in the former way, chiefly from Sicily, and is termed *crude sulphur.* It comes also from Romagna, in Italy, and from California, and considerable deposits of sulphur have been found in the island of Saba, one of the Dutch West Indies, and in Japan.

Preparation.—After importation it is purified by sublimation, and is known as *sublimed sulphur*—SULPHUR SUBLIMATUM. It is sometimes sublimed in the form of an impalpable powder, when it is called the *flowers of sulphur.* Sometimes it is cast in wooden moulds, and forms the roll-sulphur, or brimstone of commerce. Sublimed sulphur contains more or less sulphuric acid, and for medicinal use it is further purified by washing, when it constitutes the SULPHUR LOTUM or *washed sulphur* of the Pharmacopœia.

Description.—As met with in the shops, it is a fine, bright-yellow powder, with a feeble odor and taste, insoluble in water and in alcohol, but soluble in alkaline solutions, and the oils; and when perfectly pure it is wholly volatilized by heat, and ought not to change the color of litmus-paper.

Effects and Uses.—In small and repeated doses sulphur is a gentle stimulant to the skin and mucous membranes, and in larger doses it acts as a *mild purgative*, without exciting the pulse or occasioning griping. It is probably absorbed on being converted in the small intestine, by the alkali of the bile, into a sulphide. After its continued use the intestinal gases give off sulphuretted hydrogen. Though not classed among the poisons, yet in large amounts (℥ij) it will produce violent vomiting and purging, raise the temperature, and impart to the breath the odor of sulphuretted hydrogen.

It is employed in the cases to which laxatives are applicable, and also as an alterative-diaphoretic in *chronic cutaneous diseases*, and in *rheumatism*. It is considered a specially useful laxative in *hemorrhoids*. To increase its cathartic effect it is often combined with cream of tartar or magnesia. *Externally*, it is a valuable remedy in various skin diseases, particularly the scaly and parasitic, as *scabies*, *psoriasis*, *phthiriasis*, *favus*, and *sycosis*. In psoriasis, if the scales be plentiful, they should be removed with green soap and warm water; in favus the hair is to be closely cropped and the crusts removed with poultices; the same preparatory treatment is required for sycosis. The strength may be ʒj–iv to the ℥j of ointment. Before its application in scabies the patient should thoroughly wash the part with hot water and soft soap. It is also used in *acne* in the form of ointment.

As a Disinfectant.—Sulphur, when ignited, unites with the oxygen of the air to form sulphurous acid gas, or more correctly, sulphurous anhydride. In this state it is powerfully germicidal against atmospheric microbes, as has been recently shown in some clever experiments by Dubief and Gaillard[*] For the purpose of disinfecting a contaminated apartment about ℥j per cubic yard may be ignited in earthen saucers; all the openings should be tightly closed, and the process kept up 24 hours (Dujardin-Beaumetz[†]). To facilitate the burning Pasteur suggests the addition of a little alcohol, and to prevent the tarnishing of metal-work vaseline should be smeared over it.

Administration.—Dose, ℥j–iij or iv, in syrup, treacle or milk. *Externally*, it is applied in the form of vapor bath or *ointment*. *Unguentum sulphuris* consists of 30 parts of sulphur and 70 parts of benzoinated lard rubbed together until thoroughly mixed. *Unguentum sulphuris alkalinum* (*alkaline sulphur ointment*) consists of sulphur, 20 parts, potassium carbonate, 10 parts, water, 5 parts, and benzoinated lard, 65 parts, rubbed together until thoroughly mixed.

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[*] *Bull. Gén. de Thérap.*, Août 30, 1889, p. 175.

[†] *Therap. Gazette*, Feb. 15, 1889, p. 73.

Sulphur Præcipitatum (*Precipitated Sulphur*, or *Lac Sulphuris*) is prepared by boiling together sulphur, slaked lime and water and afterward precipitating the sulphur by hydrochloric acid. It is a finer and softer powder than sublimed sulphur, is of a paler yellow color, with a grayish tint, and is not often gritty between the teeth. When exposed to the air, however, it is liable to become contaminated with sulphuric acid, and, as found in commerce, it is often adulterated with calcium sulphate. Its *effects*, uses, and doses are the same as those of sublimed sulphur.

Potassa Sulphurata (*Sulphurated Potassa*), or *Liver of Sulphur*, is prepared by rubbing together one part of sublimed sulphur with two parts of potassium carbonate, afterward melting the mixture, and pouring it when cold into a bottle. Its composition is variable and uncertain, but it should contain about 50 per cent. of potassium sulphide. When freshly and carefully prepared it is of a liver color, has an acrid, alkaline, disagreeable taste, and forms an orange-yellow solution with water. This preparation and the other sulphides probably act like sulphur. They are, perhaps, in part decomposed by the acids of the stomach, but any liberated sulphur must be again combined with the alkali of the bile.

TOXICOLOGY.—Taken in large quantities sulphurated potassa is a corrosive poison, capable of producing fatal gastro-enteric inflammation. Three cases of poison are reported from it by Orfila* in one of which ʒiij, proved fatal.

MEDICINAL USES.—The sulphides are considered to be *expectorant*, *diaphoretic*, and *alterative*. They have been especially recommended in the *scrofulous abscesses* of children—the calcium sulphide being preferred. Dose, for an adult, gr. ij–x, several times a day. They are used *externally* in scaly skin diseases in the form of ointment (ʒss to ℥j of lard), and of baths.

SULPHUR-WATERS—NORTH AMERICAN.

Blount Springs (*Blount County, Alabama*).—This water, analyzed by Prof. R. Brumby, contains magnesium, calcium, and iron carbonates, sodium chloride, with carbonic acid and sulphuretted hydrogen. It is a saline sulphur-water.

Alpena Well (*Alpena County, Michigan*).—Contains the alkaline, earthy, and iron carbonates with an abundance of sulphuretted hydrogen.

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* "Toxicologie Générale," Vol. I, p. 177.

Sharon Springs (*Schoharie County, New York*).—These waters contain sodium, magnesium, and calcium chlorides, the alkaline and earthy carbonates, and in small proportion sodium and calcium sulphides and sulphuretted hydrogen.

Richfield Springs (*Otsego County, New York*).—Prof. Reid's analysis shows these waters to contain magnesium and lime carbonates, Epsom salt, calcium sulphate, and sulphuretted hydrogen. May be taken two to four glasses daily; also as baths.

Minnequa Springs (*Bradford County, Pennsylvania*).—Contains sodium, magnesium, and lime carbonates, iron oxide and an undetermined quantity of sulphuretted hydrogen. It is a chalybeate sulphur-water.

Jordan's White Sulphur Springs (*Frederick County, Virginia*).—They contain the earthy, alkaline, and iron carbonates in small proportion with sulphuretted hydrogen. May be taken freely.

Greenbrier While Sulphur Springs (*Greenbrier County, West Virginia*).—They contain the earthy and alkaline carbonates and chlorides, Epsom salt, calcium sulphate, silicates, and the following gases: carbonic acid, sulphuretted hydrogen, oxygen and nitrogen. An excellent aperient alterative water with a diuretic action.

SULPHUR-WATERS—EUROPEAN.

Aix-la-Chapelle (*Rhenish Prussia*).—Analyzed by Liebig; temperature 131° Fahr. Contains the alkaline, earthy and iron carbonates, sodium chloride in considerable quantity, Glauber's salt, sodium iodide and bromide, with carbonic acid, sulphuretted hydrogen, and nitrogen gases. The Nenndorf and Meinberg wells are very similar in composition, but in temperature they are about 80° lower. These waters possess an alkaline, saline and sulphurous taste, and are diaphoretic and diuretic.

Aix-les-Bains (*Savoy*).—Analyzed by Bonjean. The eau de soufre has a temp. of 108-11° Fahr., contains the alkaline, earthy, and iron carbonates with traces of the sulphates, and carbonic acid, nitrogen, and sulphuretted hydrogen gases. They are employed mostly as baths. The springs at **Baréges**, and **Bagnères de Luchon**, in France, are very similar in composition except as to temperature, the former being 64° Fahr., the latter 131° Fahr.

MEDICINAL USES.—The characteristic of the sulphur waters is the odor of sulphuretted hydrogen. The composition and effects vary according to the preponderance of certain ingredients. Those that contain a goodly proportion of common salt are termed saline-sulphur; when they have a large quantity of calcic salts they are constipating. Some are sedative, others exciting, particularly those of high temperature. They all are diaphoretic and diuretic. These waters are prescribed internally and externally in various cutaneous affections, as *chronic eczema*, *lichen*, *psoriasis*, *phthiriasis*, and *syphilitic eruptions*. The warm sulphur baths are beneficial in *gout* and *chronic rheumatism*, *colica Pictonum*, *hepatic engorgement*, and *hemorrhoids*.

SALINE CATHARTICS.

Before considering in detail the precise action on the alimentary tract of the saline cathartics, a brief argument will be offered relating to the opinions and work of the investigators who have experimented physiologically with these substances. There has been much controversy between numerous investigators as to their exact method of action upon the intestinal canal, the question being this: Do they effect catharsis, by inciting peristalsis; or is it due to an increased discharge of fluids? Considerable practical evidence has been brought forward by Thiry and Radziejewsky to prove that cathartic drugs, especially the drastics, operate by arousing peristalsis, but their work, though apparently accurate, lacks the confirmation of observers whose results cannot be impugned, and, moreover, the latter have much clinical evidence to substantiate their side of the question. Among those who have devoted largely of time and labor in the laboratory to the elucidation of the action of the salines are Lauder Brunton,* Anstie,† Moreau,‡ Matthew Hay § and Vulpian.|| The work of Hay, with which we agree, is most elaborate, being a model of research. Concisely stated, all of these observers are unanimously of the opinion that catharsis is induced chiefly by augmented intestinal secretion, and they offer many incontrovertible facts to substantiate their opinions. We quote some of Hay's conclusions:

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* *Practitioner*, Vol. XII, pp. 342 and 403. "On the Actions of Purgative Medicines."

† *Med. Times and Gazette*, Vol. I, pp. 326 and 487. "Report on the Action of Podophyllin."

‡ *Arch. Gén. de Méd.*, XVI. 6*ième* ser., p. 234. "L'action du sulphate de magnésie sur l'intestin."

§ *Journ. of Anat. and Phys.*, Vol. XVI, pp. 343, 391; Vol. XVII, pp. 62, 223, 465. "The Action of Saline Cathartics."

|| *Gazette Médicale de Paris*, 1873, p. 300.

"A saline purgative always excites more or less secretion from the alimentary canal, depending on the amount of the salt and the strength of its solution, and varying with the nature of the salt. The excito-secretory action of the salt is probably due to the bitterness as well as to the irritant and specific properties of the salt, and not to osmosis. The low diffusibility of the salt impedes the absorption of the secreted fluid. Purgation will not ensue if water be withheld from the diet for one or two days previous to the administration of the salt in a concentrated form. *Cæteris paribus*, the weaker, or, in other words, the more voluminous the solution of the salt administered is, the more quickly is the maximum within the canal reached and accordingly purgation follows with greater rapidity.

"The salt excites an active secretion in the intestines, and probably for the most part in the small intestine, all portions of this viscus being capable of yielding the secretion in almost equal quantities. The bile and pancreatic juice participate but very little in the secretion. The salt does not purge when injected into the blood, and excites no intestinal secretion. Nor does it purge when injected subcutaneously, unless in virtue of its causing local irritation of the subcutaneous tissue, which acts reflexly on the intestines, dilating their blood-vessels, and perhaps stimulating their muscular movements. The sulphate of soda exhibits no poisonous action when injected into the circulation. The sulphate of magnesia is, on the other hand, powerfully toxic when so injected, paralyzing first the respiration and afterward the heart. Both salts, when administered in the usual manner, produce a gradual but well-marked increase in the tension of the pulse. The blood recoups itself in a short time by absorbing from the tissues a nearly equal quantity of their fluids. The salt after some time causes diuresis. The amount of the normal constituents of the urine is not affected by the salt. The salt has no specific action in lowering the internal temperature of the body."

Lauder Brunton (*loc. cit.*) differs from Hay's (*loc. cit.*) conclusions in that he found that purgatives reduced the arterial pressure, as shown by the sphygmograph.

Clinically, the results of these observers are supported by the fact that watery stools are characteristic of the exhibition of the salines in sufficient doses.

MAGNESIA—MAGNESIA.

MAGNESIA PONDEROSA—HEAVY MAGNESIA.

Magnesia (MgO), sometimes called *calcined* magnesia, from the mode in which it is prepared, is procured by exposing magnesium carbonate to a red heat, till the carbonic acid is wholly expelled. It is a light, fine, white, colorless, odorless powder, of a feeble, earthy taste, very slightly soluble in water, and more soluble in cold than in hot water. Heavy magnesia is a white, fine, dense powder, chemically identical with magnesia and differing from it only in the degree of aggregation of their molecules. *Henry's Magnesia*, a patent English medicine, has the advantage over the ordinary magnesia of greater density and softness, and more ready miscibility with water, and corresponds to the official magnesia ponderosa. Magnesia prepared by Husband, and Ellis, of Philadelphia, is very similar in properties to Henry's.

Effects and Uses.—Magnesia is *antacid* and *laxative*. A good deal of its cathartic effect is in part the result of its combination with the free acids of the stomach and intestines, but also of the excretion and pouring out of fluid into the intestines. When taken in large quantities, and for too long a period, it sometimes accumulates in the bowels; and hence it is best to increase its solubility by giving it with lemonade.

It is an excellent laxative where much *acidity* exists in the stomach, and is particularly useful in infantile cases. As an antacid and laxative it is employed in *heartburn*, *sick headache*, *biliousness* and *duodenal catarrh*. Dose, as a *laxative*, ʒj; as an *antacid*, gr. xx, in water or milk. Of Henry's, half the quantity.

MAGNESII CARBONAS—MAGNESIUM CARBONATE.

Magnesium carbonate, sometimes called *magnesia alba*, is prepared by decomposing magnesium sulphate with an alkaline carbonate. As found in the shops it is a combination of magnesium carbonate and magnesium hydrate ($4MgCo_3,Mg2HO.5H_2O$). It occurs in the form of light, white, cubical cakes or powder; is inodorous, almost insipid, and nearly insoluble in water, but soluble in carbonic acid water.

Effects and Uses.—These are nearly the same as those of calcined magnesia; but from its effervescence with the acids of the stomach, it is apt to create flatulence, though sometimes, on this account, it is more acceptable to delicate stomachs. Dose, as a *laxative*, ʒj–ij; as an *antacid*, gr. x.

MAGNESII SULPHAS—MAGNESIUM SULPHATE.

This salt ($MgSO_4.7H_2O$), commonly called *Epsom Salt*, from its having been first procured from the Epsom mineral water in England, occurs in native crystals, and is a constituent of sea-water and many saline springs. It is obtained in England from *dolomite*, or magnesian limestone; and also from *bittern*, or the residual liquor of sea-water, from which common salt has been separated. In this country it is extensively manufactured at Baltimore and Philadelphia, by the action of sulphuric acid on *magnesite*, the silicious magnesium hydrate. It is usually met with in small acicular crystals, which are colorless, transparent and odorless, but have an extremely bitter taste. They effloresce on exposure to the air, are very soluble in water, and insoluble in alcohol.

EFFECTS AND USES.—Epsom salt is a *mild*, safe, refrigerant purgative, which, from its cheapness, is by far the most commonly employed of all cathartics. It produces free, watery purgation, with very little irritation of the intestines, stimulating the intestinal glands, but not affecting the liver. By reason of these effects it is very serviceable in conditions of *congestion*, *inflammation*, *cerebral hyperemia*, *etc.*

Matthew Hay* has called attention to the efficacy of *concentrated saline cathartics* for the removal of *dropsical effusions*, as in *pleurisy*, *hydrothorax* and *pericarditis*. He states that they concentrate the blood, increase the proportion of red globules, and produce watery stools. He used of Epsom salt ℥¾ to water f℥j. Osler† reports favorable results with Hay's method in diminishing *pleuritic effusions*. He employed ʒiv–vj to water ℥j. The stomach should be empty at the time of administration and the patient should not drink for some time afterward. In the treatment of *colica Pictonum* and the cachexia resulting from *chronic lead-poisoning*, this salt, combined with diluted sulphuric acid, is of the greatest service. It is also used in combination with opium in *acute dysentery*, but is inferior to Rochelle salts in the treatment of this complaint. It is sometimes combined with senna, sometimes with bitter infusions, and is most agreeably administered in solution in carbonic acid water. Dose, ℥ss–j.

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* *Lancet*, April, 1883, p. 678.

† *The Med. News*, Dec , 1836, p. 645.

LIQUOR MAGNESII CITRATIS—SOLUTION OF MAGNESIUM CITRATE.

Under this name magnesium citrate is employed in solution, with slight excess of acid, and in the effervescing state. It is prepared according to the following formula: citric acid, gr. 400 are dissolved in water gr. 2000, and in this solution magnesium carbonate gr. 200 are stirred until dissolved; this solution is filtered into a strong twelve-ounce bottle, containing syrup of citric acid gr. 1200; to this is added water, previously boiled and filtered enough to nearly fill the bottle; potassium bicarbonate gr. xxx are then dropped in and the bottle is immediately closed with a cork, and secured with twine; the mixture must be occasionally shaken to insure the solution of the bicarbonate. The effervescing solution has a pleasant acid taste, without anything disagreeable. It is a very grateful cathartic, and is much employed as a substitute for Epsom salt, but is more apt to produce slight griping. Dose, from a half to a whole bottle.

Magnesii Citras Granulatus (*Granulated Magnesium Citrate*) is a white, coarsely-granular salt, deliquescent on exposure to air, odorless, having a mildly acidulous, refreshing taste, and an acid reaction. Soluble with copious effervescence in two parts of water; almost insoluble in alcohol. It should be kept in closely-stoppered bottles. Its effects are similar to those of the solution, and it is used for the same purpose. It has the advantage of portability. Dose, ʒj–iv dissolved in water and taken while effervescing.

SODII SULPHAS—SODIUM-SULPHATE.

Sodium sulphate, commonly called *Glauber's Salt* ($Na_2SO_4.10 H_2O$), is a constituent of many mineral springs, and is prepared in various chemical processes. It occurs as a residuum in the manufacture of hydrochloric acid, made by adding sulphuric acid to sodium chloride, and it is obtained from sea-water in the winter season. It is found in colorless, six-sided, very efflorescent crystals, which are inodorous, but have a cooling, saline, very bitter taste. It is soluble in water, more readily in hot than cold water—and is insoluble in alcohol.

Effects and Uses.—These are very similar to those of Epsom salt, but it is more bitter and nauseous, and is now little used. It is a mild hepatic stimulant, according to the experiments of Rutherford on dogs. The effects of the sodium salts have already been considered (*vide* index). It has an antiplastic action on the blood, due to the sodium which it contains. Dose, ℥j; in an effloresced state, ℥ss.

MANGANI SULPHAS--MAGANESE SULPHATE.

This salt ($MnSO_4.4H_2O$) is made by heating the native black oxide with concentrated sulphuric acid. It occurs in rhombic, prismatic crystals, of a pale-rose or pink color, transparent, and of an astringent and bitterish taste. It is very soluble in water, insoluble in alcohol.

EFFECTS AND USE.—These are said to resemble *Glauber's Salt*, acting also as a cholagogue. Dose, as a purgative, ℥j–ij. As a tonic (*vide* p. 175) it has been given in doses of gr. v–xx.

SODII PHOSPHAS—SODIUM PHOSPHATE.

The salt is prepared by digesting burnt bone with diluted sulphuric acid, and decomposing the resulting monocalcic phosphate with sodium carbonate. It is disodic phosphate, and occurs in large rhombic, colorless, transparent, very efflorescent crystals ($Na_2HPO_4.12H_2O$), which are wholly soluble in water and insoluble in alcohol, and have a pleasant saline taste, resembling common salt.

EFFECTS AND USES.—Sodium phosphate is a *mild* saline cathartic, well adapted, from its agreeable taste, to the cases of children and delicate persons. It is an hepatic stimulant, increasing the amount of bile secreted, although making it more watery, and having a very slight irritant action on the intestinal mucous membrane (Rutherford). It increases the alkalinity of the blood and diminishes the amount of urea excreted. It is a constituent of the blood in health, and has been recommended in *cholera* as a restorative of deficient saline matters, to repair the drain on the system caused by *chronic suppurations*, and also in diseases where there is a deficiency of phosphatic matter in the bones, as in *rickets*. In all catarrhal conditions of the gastro-intestinal mucous membrane, notably in *catarrhal jaundice*, sodium phosphate is of the greatest utility, and it is one of the agents used to promote the solution of *gall-stones* in the dose of ℥j t. d. in water, taken before meals and continued several weeks. It is highly recommended also in chronic *infantile diarrhœa* with pasty stools (Routh). Dr. Peters* advises the employment of sodium phosphate in chronic rheumatism for the reasons, that, in addition to its laxative action, it lessens the gastro-intestinal acidity, and makes the blood, urine, and perspiration more alkaline.

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* *N. Y. Med. Record*, Jan. 23, 1886.

Administration.—Dose, as a *cathartic*, ʒvj, in broth or soup. As an *alterative*, gr. xx-ʒj, three or four times a day.

Sodii Pyrophosphas (*Sodium Pyrophosphate*) ($Na_4P_2O_7.10H_2O$) occurs in colorless, translucent prisms, odorless, but having a cooling, saline taste, and a slightly alkaline reaction. The effects and uses are said to resemble those of sodium phosphate. Dose ʒss-iv.

POTASSII SULPHAS——POTASSIUM SULPHATE.

This salt exists in both kingdoms of nature, and is obtained artificially from the residuum of the distillation of nitric acid from potassium nitrate and sulphuric acid. It occurs in small, hard, colorless, inodorous crystals (K_2SO_4), of a saline, bitter taste, which have no water of crystallization, and are unalterable in the air. They are moderately soluble in water, and are insoluble in alcohol.

Effects and Uses.—The physiological effects of the potassium salts have already been fully considered (*vide* p. 253). In small doses it is considered a *mild* and safe cathartic; but in large doses has proved a violent and even fatal poison producing symptoms of cholera. It is thought to act as a *galactifuge*, and is administered with this view in France. Dose, as a cathartic, gr. xv-ʒj-ij; but it is little employed in this country. From its hardness and dryness it is useful to promote the trituration and division of powders.

POTASSII BITARTRAS——POTASSIUM BITARTRATE.

This salt, well known as *Cream of Tartar*, and termed also acid potassium tartrate, is the monopotassic tartrate ($KHC_4H_4O_6$). It exists in many vegetable juices, particularly the juice of grapes, from which it is obtained.

Preparation and Description.—It is deposited in an impure form, during fermentation, on the sides of wine-casks, and in this state occurs in crystalline cakes, of a reddish color, known as *argol* or *crude tartar*. This is purified by solution and crystallization, and forms a white crystalline mass or powder, termed cream of tartar. It is without smell, has an acidulous and gritty taste, is very slightly soluble in water, and insoluble in alcohol; when heated in a close vessel, it is converted into black flux, a compound of charcoal and potassium carbonate.

Effects and Uses.—In small doses it is *diuretic* and *refrigerant;* in larger doses, *cathartic;* and in excessive doses it will produce gastro-intestinal inflammation. It is employed to form a refrigerant drink, and as a gentle aperient in *fevers;* as a diuretic and hydragogue cathartic in general dropsy depending on *valvular disease of the heart*, and in *acute Bright's disease.*

Administration.—Dose, as an *aperient*, ʒss-j; as a *cathartic*, ℥ss-j; as a *diuretic*, gr. x-ʒj, in repeated doses. It enters into the *compound powder of jalap.*

POTASSII TARTRAS—POTASSIUM TARTRATE.

This salt, formerly called *Soluble Tartar*, is obtained by saturating the excess of acid in cream of tartar with potassium carbonate, and is dipotassic tartrate ($2K_2C_4H_4O_6.H_2O$). It occurs in white deliquescent crystals or grains, of a saline, somewhat bitter taste, and is very soluble in water. It is a gentle cathartic and diuretic, at present not much used. Dose, ℥ss to j.

POTASSII ET SODII TARTRAS—POTASSIUM AND SODIUM TARTRATE.

This salt ($KNaC_4H_4O_6.4H_2O$), commonly called *Rochelle Salt*, is made by saturating the excess of acid in cream of tartar with sodium carbonate. It occurs in large, transparent, colorless, prismatic, slightly efflorescent crystals, of a mildly saline and bitter taste, readily soluble in cold water, and still more so in hot water.

Medicinal Uses.—It is the best saline for use in the treatment of *acute dysentery*, combined with opium and given in small doses frequently repeated until ℥j has been taken in the first 24 hours, after which the dose is decreased. ℞ Potassii et sodii tartratis, ʒj; tincturæ opii, ♏ x; aquæ, f℥ss. M. S.—Every two hours. It is a mild and pleasant aperient, well adapted to *gouty* cases and cases of *uric acid diathesis*, but it renders the urine alkaline, and should not therefore be given to persons suffering with phosphatic deposits in the urine.

Administration.—Dose, ℥ss-j. It is usually exhibited in the form of *pulvis effervescens compositus* (*compound effervescing powder*), or *Seidlitz powder*, which consists of Rochelle salt (ʒij) and sodium bicarbonate (gr. xl) in a blue paper, and tartaric acid (gr. xxxv) in a white paper. They are taken, dissolved in half a pint of water, while the liquid is in a state of effervescence, and form a very agreeable mild aperient in *biliousness*, *migraine*, etc., and are very acceptable to the stomach. They should not be kept in a damp place.

SALINE MINERAL WATERS—NORTH AMERICAN.

St. Catharine's Wells (*St. Catharine's, Ontario, Canada*). Analysis of Stephenson House Well by Prof. Croft: one pint contains potassium chloride, gr. 2.587; sodium chloride, 217.234; magnesium chloride, 24.760; calcium chloride, 108.271; ammonium chloride and silicic acid, 0.056; calcium sulphate, 15.981; magnesium iodide, 0.030; magnesium bromide, 0.045; temperature, 60° F. For internal use they must be diluted ⅛–¼ with ordinary water. They are employed also in the form of water-baths. These waters have been found beneficial and curative in *chronic rheumatism*, *gout* and *scrofula*.

Michigan Congress Spring (*Ingham County, Michigan*,). Analysis by Dr. Jennings: one pint contains sodium carbonate, gr. 8.094; magnesium carbonate, 1.421; iron carbonate, 0.143; lime carbonate, 7.782; sodium chloride, 33.349; potassium sulphate, 1.554; sodium sulphate, 3.131; silica, 0.413; carbonic acid gas, 24½ cubic inches; temperature, 53½° F. An alkaline-saline water, decidedly purgative in character; in moderate quantities is only diuretic. It is applicable to the treatment of *dyspepsia* with plethora, *obesity*, *chronic hepatitis* and *gall-stones*.

Saratoga Waters. From the analysis of these waters (see p. 349) it will be seen that they consist chiefly of sodium chloride and the alkaline carbonates. Containing so large a proportion of alkali, they may be termed alkaline-saline waters. Besides this they are highly impregnated with carbonic acid gas, rendering them palatable and easy of digestion. Their use is adapted to cases of *dyspepsia* depending on high living, and an engorged condition of the liver; in *acidity*, also in *jaundice*, due to catarrh of the biliary ducts. Since these waters contain the salines in abundance they are of a purgative nature, and hence may be useful in *habitual constipation*, *obesity* and *plethora of the abdominal viscera*. As most of them have a small proportion of lithium carbonate, particularly the Pavilion Spring, they often prove beneficial in *gout* and the *gouty diathesis*. The Columbian, Hamilton, Excelsior and Eureka Springs contain iron carbonate (about gr. ¾ to the pint), and are consequently adapted to *anemic cases*; they are to be drunk cautiously by the plethoric. The *dose* of the Saratoga waters is, as a *cathartic*, two or three glasses taken leisurely before breakfast; then a walk of ten or fifteen minutes and another glass or two; breakfast half an hour later. As an *alterative* one glass three or four times daily. The waters of the springs that contain iron should be taken one-quarter to one glass per diem.

ANALYSIS OF SARATOGA SPRINGS; SARATOGA COUNTY, NEW YORK.

One Pint Contains—	High Rock. 52° Fahr. Prof. C. F. Chandler.	Congress. 52° Fahr. Prof. C. F. Chandler.	Hathorn. Prof. C. F. Chandler.	Empire. Prof. C. F Chandler.	Columbian. J. H. Steele, M.D.	United States. Prof. C. F. Chandler.	Seltzer. 50° Fahr. Prof. C. F. Chandler.	Geyser. 46° Fahr. Prof. C. F. Chandler.	Star. 52° Fahr. Prof. C. F. Chandler.	Red Spring. Prof. J. H. Appleton.	Eureka. R. L. Allen, M.D.	Excelsior. R. L. Allen, M.D.	Hamilton. R. L. Allen, M.D.	Crystal. 50° Fahr. Prof. C. F. Chandler.
Solids.	grs.	grs.	grs.	grs.	grs.	grs.	grs.	grs.	grs.	grs.	grs.	grs.	grs.	grs.
Sodium carbonate . . .	3.024	0.934	0.372	0.782	1.336	0.405	2.552	6.175	1.097	1.107	0.625	1.875	4.281	1.212
Magnesium carbonate .	4.069	9.019	13.072	3.182	3 461	5.399	2.988	10.322	4.586	2.618	3.667	4.042	4.883	5.568
Iron carbonate	0.135	0.031	0.101	0.079	0.698	0.065	0.155	0.089	0.110	. . .	0.375	0.402	0.578	0.185
Calcium carbonate . .	11.443	12 449	14,815	9.520	8.500	8.084	7.804	14.793	10.795	7.324	5.165	9.625	12.249	8.845
Lithium carbonate . .	0.154	0.374	. . .	0.163	. . .	0.380	0.071	0.549	0.124	0.016	. . .	. . .	. . .	0.339
Strontium carbonate .	trace	trace	trace	trace	. . .	0.001	trace	0.041	trace	. . .	. . .	. . .	. . .	trace
Barium carbonate . . .	0 050	0.095	0.178	0.008	. . .	0.094	trace	0.206	0.010	. . .	. . .	. . .	. . .	0.074
Potassium chloride . .	1.122	1.006	1.199	0.536	. . .	1.078	0.167	3.079	1.212	0.686	. . .	. . .	. . .	1.040
Sodium chloride	48.766	50 055	63 746	63.328	33.375	17.734	16.786	70.260	49.795	8.699	20.852	46.330	37.332	42.058
Potassium sulphate . .	0.201	0.111	trace	0.346	. . .	. . .	0.069	trace	0.675	. . .	. . .	. . .	. . .	0.269
Sodium sulphate . . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	0.165	. . .	. . .
Magnesium sulphate .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	0.268	. . .	. . .	. . .
Sodium phosphate . .	trace	0.002	00.01	0.003	. . .	0 002	trace	trace	trace	trace	. .	. . .	. . .	0.001
Calcium phosphate . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	trace	. . .	. . .	. . .	. .
Sodium iodide	0.011	0 017	0.025	0.001	0.320	0.006	0.004	0.031	0.015	. . .	0.583	0.529	0.449	0 008
Sodium bromide . . .	0.091	1.069	0.192	0.033	. . .	0.106	0.079	0.276	0.071	. . .	0.196	. . .	. . .	0.051
Calcium fluoride . . .	trace	trace	trace	trace	. . .	trace	trace	trace	trace	. . .	. . .	. . .	. . .	trace
Sodium biborate . . .	trace	trace	. . .	trace	. . .	trace	trace	trace	trace	. . .	. . .	. . .	. . .	trace
Alumina	0.153	trace	0.016	0 052	. . .	0.012	0.047	trace	trace	[1]0 219	0.029	. . .	. .	0.038
Potassium silicate . . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	0.875	. . .	. . .
Sodium silicate	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. .	. . .	. . .	0.500	. . .	. . .
Silica	0.283	0.105	0.157	0.182	0.256	0.398	0.320	0.013	0.160	0.339	0.067	. . .	[2]0.125	0.401
Organic matter	trace	trace	trace	trace	. . .	trace	trace	trace	trace	. . .	. . .	. .	. . .	trace
Total	69.502	75.267	93.874	78.215	47.946	33.764	31.042	105.834	68.650	21 008	31.827	64.343	59.897	60.089
Gas.	cub. in	cub. in	cub. in	cub. in	cub. in	cub. in	cub. in	cub. in	cub. in	cub. in	cub. in	cub. in	cub. in	cub. in
Carbonic acid	51 (1866)	49 (1871)	47	43	34	30	40	57 (1870)	50	. . .	29	31	40	39 (1870)

[1] Alumina and ferric oxide.

[2] Silica and alumina.

Caledonia Springs (*Prescott County, Ontario, Canada*). One pint of the Saline spring, analyst, T. S. Hunt, contains: sodium carbonate, gr. 1.284; magnesium carbonate, 3.769; iron carbonate trace; calcium carbonate, .856; manganesium carbonate, trace; potassium chloride, .219; sodium chloride, 46.934; potassium sulphate, .035; sodium iodide, .010; sodium bromide, .123; alumina, trace; silica, .309; total solids, 53.539; carbonic acid gas, 4 cubic inches; flow per minute, 10 gallons; temperature, 45° Fahr. This water is alkaline in reaction; valuable in *gout*, *chronic rheumatism*, *obesity* and *scrofula*.

SALINE MINERAL WATERS—EUROPEAN.

Homburg (*Germany, near Frankfort*). Elizabeth Brunnen; analyst, Liebig; temperature, 50° Fahr. One pint contains magnesium carbonate, gr. 2.01; iron carbonate, 0 46; calcium carbonate, 10 99; sodium chloride, 79.15; magnesium chloride, 7.79; calcium chloride, 7.77; sodium sulphate, 0.38; silica, 0.32; total solids, 108.87; carbonic acid gas, 44.46 cubic inches. These waters are strongly saline and contain a fair proportion of iron. Homburg, a small village, is situated on the slope of a hill at the eastern extremity of the Taunus. There are five springs found here. Their waters are beneficial in *dyspepsia* with anemia, *obesity*, *habitual constipation*, *conditions of plethora*, *hepatic engorgement, etc.*

Kissingen (*Bavaria*). Ragoczi; analyst, Liebig; temperature, 51° Fahr. One pint contains iron carbonate, gr. 0.24; calcium carbonate, 8.14; potassium chloride, 2.20; sodium chloride, 44.71; magnesium chloride, 2.33; lithium chloride, 0.15; magnesium sulphate, 4.50; calcium sulphate, 2.99; calcium phosphate, 0.04; sodium iodide, trace; sodium bromide, 0 06; sodium nitrate, 0.07; silica, 0.09; total solids, 65.52; carbonic acid gas, 41.77 cubic inches; ammonia, 0.007. Kissingen is situated in a salubrious valley on the river Saal. Its waters are adapted to *catarrhal dyspepsia* with constipation and anemia. In *gout* accompanied by plethora, these waters are often extremely beneficial. Being cold and very saline they are not adapted to gastric maladies with inflammation.

Wiesbaden (*Germany, Duchy of Nassau*). Analyst, Fresenius; Kochbrunnen; temperature, 155.75° Fahr. One pint contains magnesium carbonate, gr. 0.08; iron carbonate, 0.04; manganesium carbonate, 0.604: calcium carbonate, 3.21; potassium chloride, 1.12; sodium chloride, 52.50; magnesium chloride, 1.57; calcium chloride, 3.62; ammonium chloride, 0.13; lithium chloride, 0.001; calcium sulphate, 0.69; calcium phosphate, 0.003; sodium bromide, 0.003; calcium arseniate, 0.001; aluminum silicate, 0.004; silica, 0 46; total solids, 63.463; carbonic acid gas, 16.7; nitrogen, 0.10. This resort is situated in a valley on the southerly exposure of the Taunus. Its climate is temperate. At Wiesbaden there are twenty-nine springs that furnish a supply of hot water, which is used for bathing in every form. In the dose of a pint these waters increase the salivary flow, produce a sense of gastric warmth, and cause a moderate alvine evacuation. In doses of 3 pints to a quart they purge freely. They increase the amount of urine, and more uric acid and urea is eliminated. The pulse is quickened, diaphoresis induced, and the feces made semi-fluid. The Wiesbaden waters are particularly beneficial in *gout* and *chronic rheumatism* without inflammatory symptoms, and the *uric acid diathesis*. They are also employed in *facial neuralgia* and *paralysis* with advantage.

Bourbonne (*France*), and Seltzer, (*Duchy of Nassau, Germany*) furnish saline waters in common use. The former is mildly laxative; the latter cool, refreshing, and slightly alkaline; it is employed as a table drink under the name *Seltzer-Water.*

Baden-Baden. These are thermo-saline; temperature, 155° Fahr., and contain sodium, chloride gr. xvi to the pint. Used chiefly for bathing purposes.

Püllna (*Bohemia*), furnishes a strong purgative water, consisting principally of sodium, gr. 124, and magnesium sulphate, gr. 93 to the pint.

Friedrickshall (*near Coburg, Germany*), yields a purgative bitter-water. It contains sodium and magnesium sulphates but in less quantity than the Püllna water. It is largely bottled for exportation, and employed in *constipation*, *diabetes mellitus*, *gastric catarrh* and *renal calculi* (Sprudel Spring).

Carlsbad (*Bohemia*) produces an alkaline-saline water, temperature 162° Fahr. Its two largest ingredients are sodium carbonate gr. ix, and sulphate gr. xx to the pint. This water is pre-eminently useful in hepatic affections as *jaundice;* also in *gout, renal calculi, gastric catarrh, chronic rheumatism, constipation, the uric acid diathesis, acidity, diabetes mellitus* and *obesity.*

Marienbad (*Bohemia*), similar to Carlsbad, except that they contain more sodium sulphate, carbonic acid and iron. The temperature is 53° Fahr.

Hunyadi Janos (*Buda-Pesth, Hungary*). Analyst, Bunsen; one pint contains chiefly sodium carbonate, gr. 13.20; calcium carbonate, 6.04; sodium chloride, 11.54; sodium sulphate, 128.97; magnesium sulphate, 137.98; carbonic acid gas free and semi-combined, 8.06 cubic inches. An agreeable and certain purgative, employed in *constipation, acidity, etc.*

Leamington (*Warwickshire, England*). Ingredients: calcium and sodium chlorides, and sodium sulphate. Prescribed in *acidity, dyspepsia* and *constipation.*

MILD ACRID CATHARTICS.

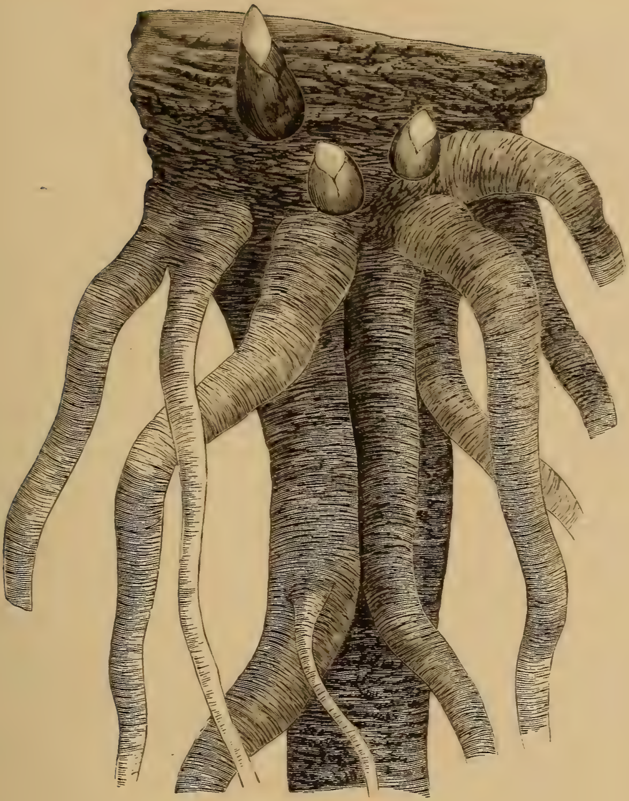
RHEUM—RHUBARB.

Rhubarb is the ROOT of Rheum officinale, and of other species of Rheum (*Nat. Ord.* Polygonaceæ). Several varieties of rheum are cultivated in Europe and this country, the leaf-stalks of which make excellent tarts.

Rhubarb is prepared for the market by being cleansed, deprived of its cortical portion, cut into pieces, pierced through the centre, strung upon a cord, and dried in the sun. Three principal sorts were long known: Chinese, Russian or Turkey, and European. The first two were obtained, by different routes, from central Asia. 1. *Chinese Rhubarb* is the common variety, and is imported principally from Canton It occurs in roundish pieces, sometimes flattened, of a dirty brownish-yellow color externally (the cortical portion apparently scraped off), having a ragged fracture (which presents red, yellowish and white veins), and is often perforated with holes, with portions of the cord on which it was dried occasionally remaining. It has a peculiar odor, an astringent, somewhat bitter taste, is gritty when chewed, and tinges the saliva of a yellow color; its powder is yellowish, with a reddish-brown tinge. 2. *Russian Rhubarb* has within a few years past disappeared as an article of commerce, and will not therefore be described. 3. *European Rhubarb* is of uncertain quality, and is seldom found in the shops. The kind most frequently met with is English rhubarb, which is thought to be derived from R. rhaponticum, and generally comes in pieces five or six inches long and about an inch thick, and is called *stick-rhubarb.* It is lighter, more spongy and redder than the Asiatic varieties, with a feebler odor and less bitter taste, and when broken exhibits a more compact and regular marbling. Lately the production of English rhubarb has much increased, and its quality has improved.

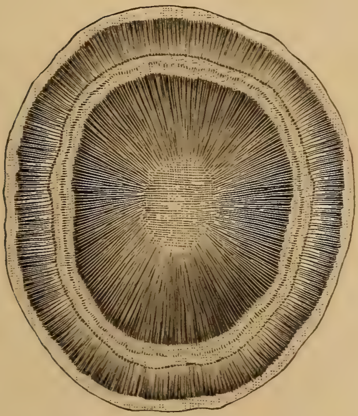
CHEMICAL CONSTITUENTS.—Rhubarb imparts its virtues to both water and alcohol, but they are impaired by long boiling. Its most important chemical consitituents seem to be *chrysophan*, *chrysophanic acid* ($C_{15}H_{10}O_4$) (an orange-yellow crystalline substance, which is probably the active ingredient of goa powder, and will be considered in the article chrysarobin—*vide* Rubefacients), four resins, *erythroretin*, *emodin*, *phæoretin*, *aporetin*, and two acids, *rheo-*

FIG. 34.



RHUBARB-ROOT.

FIG. 35.



RHUBARB; (transverse section of root)

tannic ($C_{26}H_{26}O_{14}$), and *rheumic* ($C_{20}H_{16}O_9$), but the precise chemical constituents of rhubarb are still uncertain, though they have been subjected to numerous analyses. It is supposed the therapeutical properties of the drug depend chiefly on the conjoint operation of these principles.

Effects and Uses.—In small doses, rhubarb is an *astringent tonic.* In larger doses, it is a slow and mild *cathartic*, occasionally causing griping and accelerating the pulse, but never inflaming the mucous membrane of the alimentary canal like the drastics. It tinges the milk and urine yellow. It increases the secretion of bile, which, however, is unaltered in composition (Rutherford).

Medicinal Uses.—It is much *employed* as a purgative in *diarrhœa*, in which it is particularly useful from its secondary astringent effects, and in *dyspepsia* attended with costiveness, where it acts both as a stomachic and laxative. It is not adapted to febrile or inflammatory cases. In the bowel complaints of children, rhubarb deservedly enjoys great popularity. Made into a cataplasm and applied to the abdomen, it acts as a purgative on children.

Administration.—Dose, as a *stomachic laxative*, gr. v–x; as a *purgative*, gr. xx–ʒj. The following are the official preparations: *Extract* (alcoholic), dose, gr. x–xxx; *fluid extract*, dose fʒss; *mixture of rhubarb and soda* contains sodium bicarbonate, fluid extract of rhubarb and spirit of peppermint, each 30 parts, water enough to make 1000 parts—an excellent preparation where rhubarb is indicated, combined with an antacid, especially adapted to children—dose, for a child, fʒss-j, for an adult, f℥j-iv, or more; *tincture* (100 parts contain 12 parts of rhubarb and 2 parts of cardamom, in diluted alcohol); *aromatic tincture of rhubarb* contains also cinnamon, cloves, and nutmeg, and is used in making the aromatic syrup; *sweet tincture of rhubarb* contains also glycyrrhiza, anise, and cardamom; *tincture of rhubarb and senna* (Warner's gout cordial), *tincture of rhubarb and aloes* and *tincture of rhubarb and gentian* are no longer official: the dose of all the tinctures is f℥ss–j, and they are chiefly adapted to low forms of disease and persons accustomed to the use of stimulants; *pills of rhubarb*, each pill contains rhubarb gr. iij, and soap gr. j; *compound pills of rhubarb*, each pill contains rhubarb gr. ij, aloes gr. iss, myrrh gr. j, oil of peppermint gr. $\frac{1}{10}$; *compound powder of rhubarb* (containing 25 parts of rhubarb, 65 parts of magnesia, and 10 parts of ginger); *syrup* contains also cinnamon, potassium carbonate, sugar, and water; *aromatic syrup* (contains aromatic tincture, 10 parts, syrup, 90 parts—much used in infantile cases under the name of *spiced syrup of rhubarb*)—dose, for an infant, fʒj; and *wine* contains rhubarb, 10 per cent., and calamus, 1 per cent., in stronger white wine—dose, fʒj–f℥ss. Roasting impairs the cathartic power of rhubarb, and is said to increase its astringency.

Juglans. The INNER BARK of the ROOT of Juglans cinerea, or Butternut (*Nat. Ord.* Juglandaceæ), an indigenous forest tree found throughout New England, the Middle and Western States and Canada, possesses cathartic properties resembling those of rhubarb. It is of a fibrous texture, a white color, gradually changing to a dark-brown, a feeble odor, and a bitter, somewhat acrid taste. It contains *nucin*, $C_{36}H_{12}O_{10}$ (composed of juglandic acid and juglone), some *tannic acid*, *fixed* and *volatile oils*, *resin*, etc. It is not given in substance; the *extract* is official, of which the dose is gr. v–x as a laxative, and gr. x–xxx as a decided cathartic.

ALOE—ALOES.

Aloes is the INSPISSATED JUICE of the LEAVES of Aloe socotrina (*Nat. Ord.* Liliaceæ), a succulent herbaceous plant growing in warm countries. Aloes obtained from other varieties of aloe is used, but the Pharmacopœia only recognizes Aloe socotrina as the source of official aloes. The finest kinds are obtained by exudation; those prepared by expression and by boiling are inferior. Three principal varieties are known in commerce: Cape, Socotrine, and Barbadoes aloes, the first two of which are the most used in the United States. 1. *Cape aloes* (*Aloe capensis*), which is much the most common, is obtained from the Cape of Good Hope, where it is collected indiscriminately from A. spicata and other species. Its powder is greenish-yellow; its odor is strong and disagreeable, but not nauseous. 2. *Socotrine aloes* (*Aloe socotrina*), when genuine, is the choicest variety. It is produced in the island of Socotra, on the northeastern coast of Africa, from A. socotrina, and occurs in pieces of a yellowish or reddish-brown color, becoming darker on exposure to the air, with a smooth and conchoidal fracture, the interior being lighter-colored than the exterior. Its powder is golden-yellow; its odor peculiar, but not unpleasant, and its taste bitter and disagreeable, but aromatic. *Hepatic aloes* is probably an inferior variety of Socotrine, and is seldom met with in our shops. 3. *Barbadoes* *aloes* (*Aloe barbadensis*) comes from the West Indies, the product chiefly of A. vulgaris; it is imported in gourds. The taste of all the varieties of aloes is intensely bitter and very tenacious; their odor, disagreeable.

CHEMICAL CONSTITUENTS.—Aloes yields its virtues to water and alcohol. A neutral crystalline principle, termed *aloïn*, has been extracted from it, which is supposed to be the cathartic principle, and which has been used as a purgative in doses of gr. $\frac{1}{10}$–ij; that from Socotrine aloes is termed *socaloïn* ($C_{15}H_{16}O_7$), of Barbadoes, *barbaloïn* ($C_{17}H_{20}O_7$), and of Natal, *nataloïn* ($C_{16}H_{18}O_7$). The resin of aloes, when exhausted of aloïn, possesses no purgative properties.

EFFECTS AND USES.—Aloes, in small doses, is *tonic*, and in large doses, *purgative*. As a cathartic, it is remarkable for the slowness of its operation and its *special action* on the *large intestine* and the pelvic viscera generally. Hence it is objectionable in cases of disease of the genito-urinary apparatus, pregnancy, etc.; and, on the other hand, is useful in *amenorrhœa*. It also stimulates the hepatic secretion.

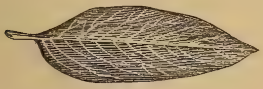
It is principally employed in cases of *dyspepsia* accompanied by costiveness, dependent on a torpid condition of the large intestine or liver. In *chronic constipation*, combined with belladonna and nux vomica and continued for some time in small doses, it often proves advantageous. ℞ Aloïn, gr. $\frac{1}{12}$; extracti nucis vomicæ, gr. ⅛; extracti belladonnæ, gr. $\frac{1}{12}$. M. ft. pil. I. Sig.—One pill t. d. after meals, to be reduced to two per diem if it cause more than one daily evacuation. Active exercise, massage and regular habits add greatly to the efficiency of this treatment. It is also useful as a mild revulsive in cerebral affections, and has proved efficacious as an anthelmintic against *thread-worms*. It was once thought that it was objectionable in *hemorrhoids*, but this affection being now considered to depend upon *relaxation* of the veins of the rectum, aloes has been administered in it upon theoretical views, and with very good results. As a purgative it holds an intermediate rank between rhubarb and senna.

ADMINISTRATION.—Dose, gr. v or x–xx, in pill; it is usually given in combination with other cathartics. Aloes is so often mixed with impurities that, for medicinal use, it is best employed under the form of *aloe purificata* (*purified aloes*), which is prepared by straining and evaporating an alcoholic solution of Socotrine aloes. The official preparations are: *Pills of aloes*, consisting of equal parts of aloes and soap, one pill containing aloes gr. ij; *pills of aloes and mastic*, 4 parts of aloes to 1 part of mastic and red rose, each (the *Lady Webster pill*, each containing aloes gr. ij); *pills of aloes and asafœtida* (one pill contains of aloes, asafœtida, and soap, j⅓ gr. each), useful in *flatulent constipation; pills of aloes and myrrh*, or *Rufus's pills*, aloes, 4 parts, myrrh 2 parts, and aromatic powder 1 part, made into pills with syrup; employed in *amenorrhœa*, each pill containing aloes gr. ij; *pills of aloes and iron*, equal parts of aloes, dried iron sulphate and aromatic powder, made into pills with confection of rose: each pill contains aloes gr. j; very useful in *amenorrhœa; aqueous extract of aloes* (*extractum aloes aquosum*), dose, gr. j–v; *tincture* (aloes and extract of glycyrrhiza, of each 10 per cent,, in diluted alcohol), dose, fʒj to f℥ss; *tincture of aloes and myrrh* (aloes and myrrh, each 10 per cent. in alcohol); *wine of aloes* (aloes 6 per cent., cardamom and ginger each 1 per cent., in stronger white wine).

SENNA.

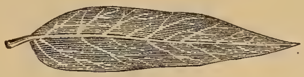
Senna consists of LEAFLETS of several species of Cassia (*Nat. Ord.* Leguminosæ), small shrubs which grow in the tropical regions of Asia and Africa. The species recognized as official are C. acutifolia and C. elongata; and beside these, C. obovata, C. lanceolata, and C. æthiopica are also generally received as sources of the drug. The commercial varieties of senna which are found in the United States are the Tripoli, the India and the Mecca senna. 1. *Alexandria senna*, which comes from the port of this name in Egypt, is made up chiefly of the leaflets of C. acutifolia (which are yellowish-green, acute in shape, and less than an inch in length), intermingled with the pods, leafstalks, flowers, etc., of this plant. 2. *Tripoli senna* consists of the leaflets of C. æthiopica, which are shorter, less acute, thinner and more fragile than those of C. acutifolia, and are generally much *broken up*. 3. *India senna* is produced in Arabia and consists of the leaflets, intermixed with the leafstalks and pods, of C elongata, and is readily recognized by the long, narrow, *pike-like* shape and dark hue of the leaflets. A finer variety of India

FIG. 36.



ALEXANDRIAN SENNA.

FIG. 37.



INDIAN SENNA.

senna, cultivated at *Tinnevelly*, in Hindostan, has been known for some years past, which is distinguishable from the common sort of India senna, by the bright-green color of the leaflets. 4. *Mecca senna* consists of leaflets, intermediate in length between those of C. elongata, and has in mass a yellowish, tawny hue. It is probably the product of C. lanceolata. Cassia obovata has been lately found growing in wild abundance in Jamaica.

Preparation and Chemical Constituents.—Commercial is prepared for use by separating the leaflets from the stalks, adulterations, etc.; the pods possess cathartic properties, but are less active than the leaves. The odor of senna is faint and sickly; its taste bitter, sweetish and nauseous. It imparts its virtues to water and alcohol, its infusion being of a reddish-brown color. The chemical composition of senna has long been an unsettled point. By the latest analysis it has been found to contain a glucoside, *cathartic acid*, which is insoluble in water, stronger alcohol and ether, but which enters readily into watery solution with alkaline and earthy bases in which state it exists in senna; this is actively cathartic. *Catharto-mannit* (*sennit*), *sennacrol* and *chrysophan* have been also obtained; and there is probably another purgative principle which has not been isolated.

Effects and Uses.—Senna is a prompt, efficient and safe *cathartic*, well adapted to febrile and inflammatory cases; it operates on the *entire tract of the intestinal canal*, and produces watery, feculent discharges. Prof. Rutherford found that senna was a mild hepatic stimulant, and rendered the bile more watery. Its tendency to gripe may in a great measure be counteracted by combining aromatics or neutral salts with it; the addition of bitters promotes its cathartic activity.

Administration.—The dose in powder is ʒss–ij; *Confectio sennæ* (made with senna, coriander, sugar, figs and pulp of prunes, tamarinds and purging cassia) is an excellent mild cathartic, much used for pregnant women; dose, ʒij. Of the *fluid extract* the dose is fʒj–iv; the *compound infusion* (black draught) contains senna, manna, magnesium sulphate and fennel; dose, f℥ss–j or more. *Syrup of senna* contains senna, sugar, alcohol and oil of coriander; dose, fʒj. *Pulvis glycyrrhizæ compositus* (*compound powder of glycyrrhiza*) consists of senna, glycyrrhiza, fennel, washed sulphur and sugar. It is an excellent purgative; dose, a teaspoonful of the powder in half a glass of water at bedtime. An extract of the pods (*legumina*) may be used; it is less likely to gripe.

LEPTANDRA.

The RHIZOME and ROOTLETS of Leptandra virginica, Culver's Root, or Culver's Physic (*Nat. Ord.* Scrophulariaceæ), an herbaceous perennial plant, three or four feet high, with leaves in whorls, and a long spike of white flowers, are ranked as a cholagogue cathartic. It consists of a dark-brown rhizome, from two to four lines in thickness, several inches in length, with numerous long, slender radicals. The odor is feeble and disagreeable, the taste bitterish and somewhat nauseous and acrid. Water and alcohol extract its virtues, which depend on *leptandrin.* It also contains *resin, saponin, tannin, mannit,* etc.

EFFECTS AND USES.—It is only a *feeble* stimulant to the liver and intestinal glands, according to the investigations of Rutherford. Adolphus[*] states that it acts on the small intestines, pancreas, and liver, while Dutcher[†] thinks it stimulates the intestinal glands only, but they offer no evidence to prove their statements. Dose of the powdered root, gr. xx to ʒj; of an impure resin mis-named leptandrin (made by precipitating a tincture of the root with water), gr. ij–iv; an *extract* (dose, gr. ij–iv) and *fluid extract* (dose, fʒss–j) also have been used.

FRANGULA.

The BARK of Rhamnus Frangula,[‡] or Alder Buckthorn (*Nat. Ord.* Rhamnaceæ) is a mild purgative of some value. Frangula is a shrub growing to the height of ten feet or more, found in wet places along the northern coast of Africa, throughout Europe, and in Siberia. It has alternate oval leaves, slightly pointed at the apex, greenish flowers in axillary clusters and small red berries, which finally become black and contain two or three roundish-angular seeds. The *bark* comes in small quills, grayish or blackish-brown externally, and marked with numerous small, whitish, transversely elongated warts; the inner surface is smooth, pale, brownish-yellow. It has no smell and a sweet and bitterish taste. It contains *frangulin* ($C_{20}H_{20}O_{10}$), *emodin, resin, tannin,* etc.

EFFECTS AND USES.—When fresh the bark is an *active emetic* and *hydragogue* cathartic, possessing irritant qualities, but it loses much of its acridity in drying, and it is therefore recommended by the Pharmacopœia to be collected at least a year before it is used. When dried it is a mild acrid cathartic, proving also somewhat diuretic. It is also an anthelmintic of considerable value against *thread-worms.* The *fluid extract* may be given in doses of fʒss–j.

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[*] *Boston Med. and Surg. Reporter*, 1868, p. 23.

[†] *Ibid.*, 1868, p. 275.

[‡] *Med. Times*, Dec. 5th, 1887, on "R. Frangula and Purshiana," Rusby.

CASCARA SAGRADA.

Cascara sagrada* or Chittem bark (not official) is the bark of Rhamnus purshiana (*Nat. Ord.* Rhamnaceæ), a small tree found on the Pacific slope, growing to the height of ten to twenty feet, with elliptic denticulate leaves, rather large white flowers in umbellate clusters, and three-lobed, three-seeded black drupes. The bark comes in thin quills, with a grayish periderm, underneath which it is of a reddish-brown color; the inner surface is smooth and yellowish. It is without smell, but has a bitter taste.

Chemical Constituents.—It contains three resins, viz., a *brown*, *red*, and *yellow*, which are probably the purgative principles, and recently a *ferment*, *glucose*, and *traces of ammonia* have been isolated.†

Effects and Uses.—Cascara bark is a good and *efficient cathartic* and is useful in *habitual constipation.* As a cathartic, Dujardin-Beaumetz‡ rates it between podophyllum and rhubarb. Dose of the fluid extract, ♏x–xxx, beginning with the smallest dose three times a day and gradually increasing until a free morning evacuation is produced after which the quantity should be carefully decreased, giving just sufficient to bring about the necessary morning evacuation. According to Cullimore,§ cascara is well combined with capsicum in obstinate constipation, which combination obviates the griping and aids the action of the former. As great difference in action is found in many preparations of the drug, it is well to begin with a smaller dose on procuring a new supply.

DRASTIC CATHARTICS.

JALAPA—JALAP.

Jalap is the tuber of Exogonium Purga (*Nat. Ord.* Convolvulaceæ), a climbing plant of Mexico, which derives its name from the city of Jalapa, near Vera Cruz. The tubers are imported usually entire but sometimes in slices. When entire, they vary in size and shape from a walnut to a large pear, are hard and heavy—externally, brown and wrinkled, and internally, grayish, with brown concentric rings; they are often furrowed with vertical incisions, made to promote drying. They have a heavy, rather nauseous smell, and a sweetish, subacrid, disagreeable taste. They yield their virtues partly to water, partly to alcohol, and completely to diluted alcohol.

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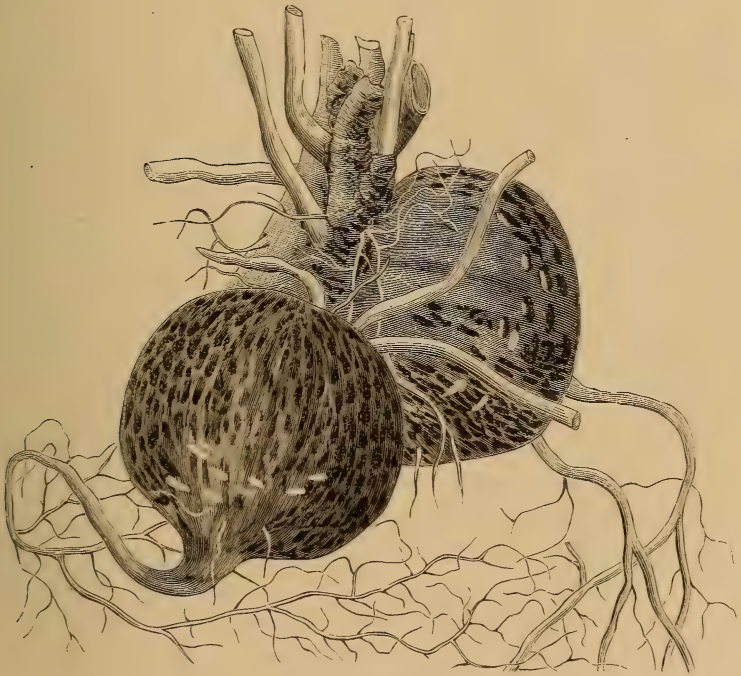
* *Med. Times*, Dec. 5th, 1887, on "R. Frangula and Purshiana," Rusby.

† *Am. Journ. of Pharm.*, Feb., 1888. "An Exam. of Cascara Sagrada," by Meier and Webber.

‡ "Les Nouvelles Médications," 1888, p 60.

§ *Lancet*, London, March, 1885, p. 502.

FIG. 38.



JALAP-TUBERS.

In the shops jalap is kept in the state of powder, which is of a yellowish gray color.

Chemical Constituents.—Its active principle is a *resin*, which consists of two portions, both of which are cathartic; one is soft and soluble in ether, the remainder is the glucoside *convolvulin* ($C_{62}H_{100}O_{32}$), insoluble in ether; it contains also *gum* and *starch*, which is apt to be attacked by worms, the worm-eaten pieces becoming thus the most active. Both the resins dissolve in oil of turpentine.

Toxicology.—In overdoses, it may produce dangerous hypercatharsis. Orfila[*] ascertained experimentally that ʒij by the mouth is the fatal amount for a dog. We have met with no fatal cases in man.

Effects and Uses.—Jalap is a powerful *hydragogue cathartic* operating with great promptness, and often causing much pain, its carthartic action seeming to be local. Rutherford found that jalap was an energetic hepatic stimulant, augmenting the flow of bile, which at the same time was made more watery. It also increases the secretion of the intestinal glands to a marked degree. *It is employed* as a hydragogue in *dropsy of cardiac or renal origin*, when it is often combined with cream of tartar; as a revulsive in cerebral and other affections, and to increase the action of calomel in *biliousness*. It is also a valuable hydragogue in *ascites*, *chronic Bright's disease*, *cerebral hyperemia*, *uremia*, and is sometimes employed as an *abortifacient*.

Administration.—Dose, gr. xv–xxx; in combination, gr. x. Of the *abstract*, gr. j–v. The *compound powder of jalap* (*pulvis jalapæ compositus*) contains 35 parts of jalap and 65 parts of cream of tartar; dose, gr. x–ʒj. The *resin* is extracted by solution in alcohol, and afterward precipitated from the tincture by water; dose, gr. iv–viij.

BRYONIA–BRYONY.

Bryonia is the root of Bryonia alba and B. dioica (*Nat. Ord.* Cucurbitaceæ), climbing perennial vines, growing in the thickets and hedges in various parts of Europe, with rough, five-lobed, toothed, alternate leaves and cymes of three or four small greenish flowers, and black or red berries containing six large spotted seeds. The root is found in the shops in transverse sections about two inches in diameter, with a grayish-brown, rough, thin bark, the central portion being whitish, with small woody bundles arranged in circles, and projecting, radiating lines. It is without smell, but has a bitter taste. The active principle is probably bryonin ($C_{48}H_{80}O_{19}$), a bitter glucoside.

Physiological Effects.—Bryonia is a powerful *hydragogue cathartic*, resembling jalap in its action, but much more violent. It also acts on the kidneys, increasing their secretion.

Toxicology.—In large doses it has produced fatal gastro-intestinal inflammation. Christison[†] records a fatal case following the swallowing of two glasses of an infusion (strength not stated), which was characterized by violent tormina and purging. If symptoms of its irritant action appear, the drug should be discontinued, and opiates, demulcents and stimulants administered.

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[*] Toxicologie Générale," t. 1, p. 683. [†] "A Treatise on Poisons," 4th edition, p. 594.

MEDICINAL USES.—In *dropsies* it may be used as a drastic cathartic, with a view of also acting on the kidneys. Phillips recommends it in the stage of effusion in *pleuritis* and *pericarditis*, and where the joints are stiff and painful from *rheumatic affections*.

ADMINISTRATION.—The *tincture* is the only official preparation; dose, f℥ss–j or more.

PODOPHYLLUM.

Podophyllum peltatum, May-apple or Mandrake (*Nat. Ord.* Berberidaceæ), is a very common indigenous herbaceous plant, with a long, creeping, perennial root, and an upright stem about a foot high, separating at the top into two petioles, each supporting a large peltate leaf, divided into five or six lobes. At the fork of the petioles it bears a single flower, which appears in May, the fruit ripening in September. The RHIZOME and ROOTLETS are the parts used. The rhizome is found in the shops in wrinkled, jointed, cylindrical pieces, about two lines in diameter, of a brown color externally, and yellowish within, having a tuft of about ten nearly simple fragile rootlets on its under surface. The powder is yellowish-gray, and has a sweetish smell; its taste is at first sweetish, afterward bitter, acrid and nauseous.

CHEMICAL CONSTITUENTS.—Diluted alcohol is the best solvent of podophyllum, which has been found to contain two *resinous* cathartic principles; one neutral, the other acid in reaction (*podophyllinic acid*). According to V. Podwissotzki, of Dorpat, podophyllum and podophyllin both contain a resinous, bitter, amorphous substance, which is very active and which he calls *podophyllotoxin.* This consists of two principles, picropodophyllin (crystalline, bitter) and podophyllinic acid (inert). Power* has shown that the rhizome contains neither berberine nor other alkaloid, and his investigations have been confirmed by Maisch.

TOXICOLOGY.—Dr. Dudley† reports the fatal poisoning of a woman who swallowed gr. v of resina podophylli in mistake for mandrake. She was seized with biliary purging and vomiting, which was followed by a comatose condition, weak pulse, sighing respiration, ending in death in 2½ days.

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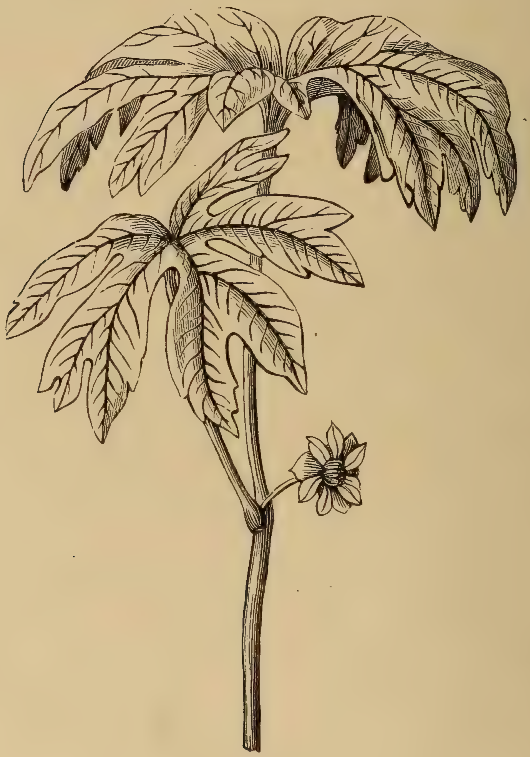
* *Proceedings* Am. Pharm. Assoc., 1877, p. 420. "On the Resin of Podophyllum Peltatum."

† *N. Y. Med. Record,* April 12, 1890, p. 409.

EFFECTS AND USES.—*Podophyllum* is an active *hydragogue cathartic*, with an especial determination to the *upper portion of the alimentary canal*, and a pretty decided cholagogue action which, according to Rutherford, is due to stimulation of the hepatic secreting apparatus, and is greater when purgation is not profuse, and *vice versa*. He also concludes that the purgation is due to intestinal irritation, which is essentially the conclusion reached by Anstie.* Podwissotzki found that the effects of podophyllum depended upon

FIG. 39.



PODOPHYLLUM PELTATUM.

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* *Med. Times and Gazette*, Vol. 1, pp. 325, 487; "Report on the Phys. Action of Podophyllin."

picropodophyllin, small doses of which caused purging, while large doses produced vomiting. As this is very expensive when pure, he recommends a 1 per cent. solution of *podophyllotoxin* in alcohol, which he gives in doses of gtt. xxx in wine. As a *cholagogue* and *purgative*, one of the following pills may be given at bedtime: ℞ Resinæ podophylli, gr. ij; extracti colocynthidis compositi, gr. xxiv; extracti belladonnæ, gr. iij. M. Ft. pil. xij. The hydragogue effects of podophyllum make it useful in *ascites* and *dropsy*. It is an ingredient in several cathartic nostrums.

ADMINISTRATION.—Dose, in powder, gr. xx; of the *abstract*, gr. ¼–j; of the *fluid extract*, ♏x-xx; of the *extract* (alcoholic), gr. v-xv; of the *resin*, gr. ¼–j.

CHELIDONIUM.

Chelidonium majus, known also as Celandine or Tetterwort (*Nat. Ord.* Papaveraceæ), is a perennial HERB growing in waste places, indigenous to Europe, but naturalized in North America. The stem is about two feet high, and hairy; the leaves are alternate, the upper ones sessile, light-green above and glaucous beneath, lyrately pinnatifid, the pinnæ ovate-oblong, obtuse, coarsely crenate or incised. The flowers appear from May to September, are of a bright golden-yellow color, and arranged in small axillary umbels on long peduncles.

CHEMICAL CONSTITUENTS.—Chelidonium contains two alkaloids, *chelerythrine* ($C_{19}H_{17}NO_4$, not identical* with sanguinarine) and *chelidonine* ($C_{19}H_{17}N_3O_3$), combined with *chelidoninic acid*, which is identical† with succinic acid.

EFFECTS AND USES.—The physiological action of this drug has not been investigated. It has been used as an hydragogue cathartic, and is said to possess narcotic properties. Binz and Phillips both believe that it exerts a stimulating effect upon the hepatic secretions, and class it with podophyllum and iris. Dose of the powder, gr. x–ʒj; or it may be given in extract or infusion. There are no official preparations.

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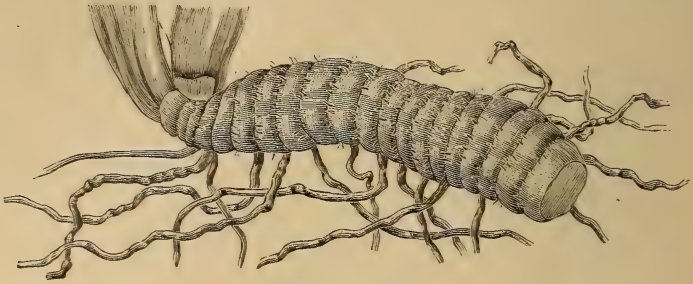
* *Pharm. Zeitung*, Berlin, 1886, p. 577; also *Journ. de Méd. de Chir. et de Pharm.*, Bruxelles, 1868, p. 268.

† *Ber. der deutsch chem. Ges.*, 1886, XV, p 704.

IRIS.

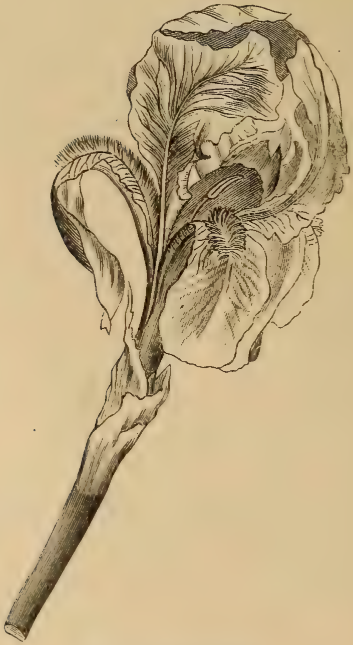
The RHIZOME and ROOTLETS of Iris versicolor, or Blue-flag (*Nat. Ord.* Iridaceæ), are used as a powerful hepatic stimulant.

FIG. 40.



IRIS VERSICOLOR; RHIZOME AND ROOTLETS.

FIG. 41.



IRIS VERSICOLOR.

The Blue-flag is found in the swampy meadows of North America, having sword-shaped leaves and a stout stem, bearing a few blue flowers, appearing late in the spring. The rhizome is horizontal and jointed; is long and cylindrical in its lower half, broad near its upper extremity, and terminated by a circular scar, annulated from the leaf-sheaths, of a grayish-brown color, with long rootlets crowded near the broad end. It has a slight odor and a nauseous, acrid taste (Maisch). It contains a *resin*, to which probably its medicinal qualities are due.

Effects and Uses.—In large doses the fresh plant causes violent *vomiting* and *purging*, with much depression: in smaller doses it is a *cholagogue* and *diuretic*. The qualities are impaired by drying. Rutherford found that *iridin* (an impure oleo-resin) was a powerful hepatic stimulant, producing less intestinal irritation than podophyllin, but greater purgation than euonymin. It was also a decided stimulant to the intestinal glands. It is highly recommended in *jaundice* of malarial origin, and may be given with advantage in *torpidity of the liver* and *dropsy*. The *fluid extract* (*extractum iridis fluidum*) may be given in doses of ♏xx–f℥j. An *extract* also official.

EUONYMUS.

Euonymus or Wahoo is the bark of Euonymus atropurpureus (*Nat. Ord.* Celastraceæ), a handsome shrub of northern and middle portions of the United States, found in shady woods. "Its branches are slightly quadrangular; the leaves opposite, petioled, elliptic-ovate, serrate, and pointed; the flowers dark-purple, in loose cymes of three to six, and appear in June." The fruit matures in autumn, and consists of pendulous capsules of a bright crimson color. The bark, as seen in the shops, is of a grayish color, mottled with blackish patches on its outer surface, which is detached in thin and small scales; inner surface tawny and smooth. It is without smell, and has at first a sweetish taste, which afterward becomes bitter and acrid. It contains a *bitter-principle*, *euonymin*, *resins*, *euonic acid*, etc.

Effects and Uses.—Euonymus is an excellent *cathartic*, increasing the intestinal secretions to some extent, and acting as a powerful hepatic stimulant. It may be advantageously used in cases of *torpor of the liver* and *constipation*. The *extract* is the only official preparation; dose, gr. iij–v.

SCAMMONIUM—SCAMMONY.

Scammony is a resinous exudation from the root of Convolvulus Scammonia (*Nat. Ord.* Convolvulaceæ), a twining plant of Syria.

PREPARATION, DESCRIPTION AND CONSTITUENTS.—The finest kind is the product of exudation from the sliced root; but most of the drug which reaches us is probably obtained by expression, or by evaporation of a decoction of the root. It comes from the Levant. Genuine scammony, termed *Virgin Scammony*, occurs in light, irregular, friable pieces, of various shades of color, from dark-ash to dark-olive, covered with a whitish-gray powder, and breaking with a bright-greenish fracture; they should not effervesce with an acid. The scammony of the shops, which is always more or less adulterated, is in hard, heavy, saucer-shaped cakes, from four to six inches in diameter (sometimes broken into pieces), of a dark-ash or slate color. The powder is light-gray; the smell disagreeable, like that of old cheese, the taste at first feeble, afterward bitterish and acrid. Scammony is a gum-resin, the *resin* constituting from 80 to 90 per cent. of the weight of good scammony, and called *scammonin* ($C_{34}H_{56}O_{16}$). It is a colorless and tasteless substance, having a peculiar faint, sweetish smell, and being soluble in alcohol and ether.

A factitious scammony made in France, and known as *Montpellier Scammony*, is occasionally imported into the United States. It is blacker than the genuine article, has a feeble balsamic odor and a very bitter, nauseous taste.

TOXICOLOGY.—There are no recorded fatal cases of poisoning by scammony. Orfila* ascertained that so much as ℥iv in dogs only produced diarrhœa.

EFFECTS AND USES.—Scammony is an energetic *hydragogue cathartic*, operating sometimes with great violence, and seldom given except in connection with other cathartics. When active catharsis is indicated it may be employed in *ascites*, *chronic Bright's disease*, *cerebral hyperemia*, and guardedly as an *abortifacient*.

ADMINISTRATION.—Dose, gr. v–xv of the pure drug, gr. x–xxx of the drug of the shops; of the *resin*, gr. iv–viij. Scammony-resin is of pleasanter smell and taste than jalap-resin, produces less griping, and is less apt to cause vomiting. It is much used in the form of *compound extract of colocynth*.

COLOCYNTHIS—COLOCYNTH.

Colocynth is the FRUIT (deprived of its rind) of Citrullus Colocynthis or Bitter Cucumber (*Nat. Ord.* Cucurbitaceæ), an annual plant of the south of Europe and parts of Asia and Africa, resembling the common watermelon. The fruit has a thin but hard rind, but is *peeled* and dried for exportation, and comes to us from the Levant.

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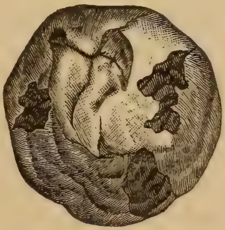
* "Toxicologie Générale," Vol. I, p. 758.

Description and Constituents.—It consists of light, whitish, spongy balls, about the size of a small orange, filled with numerous seed. For medicinal use the *pulp* only is employed, and the seed, which are inactive are rejected. The pulp has a feeble odor and a nauseous, intensely bitter taste. It yields its virtues to both water and alcohol, and contains a peculiar glucoside termed *colocynthin* ($C_{56}H_{84}O_{23}$), *resin*, *colocynthitin*, etc.

Toxicology.—Christison* describes a case in which a teaspoonful and a half of the powder killed a man, while Huseman† mentions an instance in which ʒ⅔ proved fatal to a woman, and of recovery after swallowing ʒiij.

Fig. 42.



COLOCYNTH (PEELED).

Effects and Uses.—Colocynth is an *hepatic stimulant*, increasing the amount of the biliary constituents as well as rendering the bile more watery and at the same time stimulating the intestinal glands (Rutherford). It is a violent *hydragogue carthartic*, acting sometimes very harshly even in small doses, and in overdoses producing dangerous, and occasionally fatal, enteric inflammation. Its chief use is to unload the bowels in obstinate constipation.

Administration.—The dose is gr. v–x. It is seldom, however, administered alone. The *extract* (alcoholic) is used chiefly in the preparation of the *compound extract*, which contains also aloes, resin of scammony, cardamom and soap; this is a favorite prescription, but it is apt to gripe, and it is well to combine some aromatic with it, as a little oil of cloves or capsicum; dose, gr. v–x.

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* "A Treatise on Poisons," 4th ed., p. 595.

† "Handbuch der Toxicologie," p. 625.

CAMBOGIA—GAMBOGE.

Gamboge is a GUM-RESIN procured from Garcinia Hanburii (*Nat. Ord.* Guttiferæ), a tree of Siam and Cochin-China.

PREPARATION, DESCRIPTION AND CONSTITUENTS.—The juice is collected in a bamboo joint as it exudes from a spiral incision in the bark, extending nearly round the tree, and is afterward reduced to a solid consistence by the aid of heat. The sap exudes slowly for several months, and the tree is not injured by the process. It is imported from Canton and Calcutta, and occurs in cylindrical rolls from one to three inches in diameter, of an orange color, known as *pipe gamboge*, or in irregular masses (which are less pure), weighing two to three pounds or more, called *cake* or *lump gamboge*. Good gamboge is opaque, brittle, inodorous, nearly insipid, and breaks with a vitreous fracture; its powder is bright-yellow. It is a gum-resin, forming a yellow, opaque solution with water and a golden yellow solution with alcohol; it contains from 20 to 25 per cent. of gum and from 75 to 80 per cent. of a resin termed *cambogic acid* ($C_{20}H_{23}O_4$).

TOXICOLOGY.—Christison* mentions a case in which ʒj proved fatal, the symptoms being excessive vomiting, purging and faintness.

EFFECTS AND USES.—Gamboge is a powerful *hydragogue*, and in overdoses has proved fatal. Sometimes it causes vomiting, and in large amounts has produced death merely from depression. It is employed in *obstinate constipation;* in *dropsies*, combined with cream of tartar or jalap; and has been used to destroy *tænia solium.*

ADMINISTRATION.—Dose, gr. ij.–vj. It is usually prescribed with other and milder cathartics, to promote and accelerate their action. *Compound cathartic pills* (*pilulæ catharticæ compositæ*) are made by mixing compound extract of colocynth (gr. 130), extract of jalap and calomel (of each, gr. 100), and gamboge (gr. 25), with water, forming a pilular mass, to be divided into 100 pills. Three of the pills, containing gr. 10$\frac{13}{20}$ of the mass, represent gr 3.9 of compound extract of colocynth, gr. 3 of extract of jalap and calomel each, and gr. ¾ of gamboge.

ELATERINUM—ELATERIN.

Elaterine ($C_{20}H_{28}O_5$) is a NEUTRAL PRINCIPLE extracted from elaterium, a substance deposited by the *juice of the fruit* of Ecballium Elaterium, or Squirting Cucumber (*Nat. Ord.* Cucurbitaceæ), an annual vine of the south of Europe, now cultivated in England. The fruit has the shape of a small oval cucumber, and, when fully ripe, separates from the peduncle, and throws out its juice and seeds with considerable force, through an opening in the base.

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* "A Treatise on Poisons," 4th ed., p. 603.

PREPARATION AND CONSTITUENT.—Pure elaterium is obtained by slicing the fruit and allowing the juice to drain through a sieve. The juice deposits a *sediment*, which dries in very light, thin, nearly flat, pulverulent, greenish-gray cakes, and is the genuine elaterium. It is almost inodorous, and has a bitter, acrid taste. The commercial elaterium, which is obtained from England, is made by expression. The drug is to be considered inferior when it is dark-colored, much curled, and hard. Elaterium yields its virtues to alcohol and not to water. *Elaterin*, its active principle, crystallizes in beautiful colorless, needle-shaped crystals, without smell, but of a bitter, sharp taste, insoluble in water, but readily soluble in alcohol.

TOXICOLOGY.—Beck * mentions a case in which extract of elaterium, gr. ij$\frac{2}{5}$, with gr. xvj of rhubarb caused death, the chief symptoms being incessant vomiting and purging.

EFFECTS AND USES.—Elaterium is an *hydragogue cathartic* of great violence of operation, possessing some diuretic action, and in overdoses has frequently proved fatal. It is a very efficient remedy in the treatment of *dropsies*, and is also a useful revulsive in *cerebral affections;* but in administering it, considerable caution is required. It is occasionally employed as an hydragogue in *ascites*, *chronic Bright's disease*, *cerebral hyperemia*, and as an *abortifacient*.

ADMINISTRATION.—*Trituration of elaterin* (*trituratio elaterini*) consists of elaterin 10 parts and sugar of milk 90 parts, thoroughly triturated; dose, gr. ¼–j. It is safest to begin with the smaller dose. *Elaterin* proves powerfully cathartic in doses of gr. $\frac{1}{20}$–$\frac{1}{12}$.

OLEUM TIGLII—CROTON-OIL.

Croton oil is a FIXED OIL obtained from the SEEDS of Croton Tiglium (*Nat. Ord.* Euphorbiaceæ), a small tree of the East Indies. The croton-seeds resemble the castor-seeds in shape and size, and consist of a blackish shell, sometimes covered with a yellowish-brown epidermis, and inclosing a yellowish oily kernel. They are highly irritant and cathartic, but are not imported into this country.

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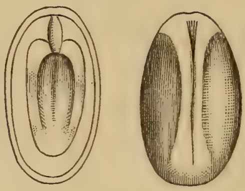
* "Med. Jurisprudence," 6th ed., II, p. 578.

CHEMICAL CONSTITUENTS.—They contain a *volatile oil*, a FIXED OIL, *retin*, *acetic*, *butyric*, and *valerianic acids*, together with an acid termed *tiglinic* ($C_5H_8O_2$). The CROTON OIL of the shops is obtained by expression, and is a mixture of the fixed oil proper, the resin and tiglinic acid. According to Senier* the vesicating principle resides in the non-volatile fatty acids, or in that part of the oil soluble in alcohol. The oil is made in both India and England, the Indian oil being of a pale straw color, and the English reddish-brown; the latter is the variety now found in the shops. It has a viscid consistence, which is increased by age, a faint, peculiar odor and an extremely acrid, pungent taste; it is soluble in ether and the volatile and fixed oils, and partially so in alcohol. The drastic principle has been found by Senier (*loc. cit.*) to exist in that portion of the oil insoluble in alcohol, which he styles the "Alcohol non-soluble, non-vesicating oil." This he determined experimentally to be purgative in the dose of ♏ $\frac{1}{12}$–$\frac{1}{2}$, his work being confirmed by Dr. Meek (same article as Senier's). *Tests.*—There are no exact chemical tests by which croton oil can be recognized in medico-legal cases.

FIG. 43.



CROTON-OIL SEEDS.

TOXICOLOGY AND ANTIDOTES.—In overdoses it has frequently proved fatal, destroying life rather by its depressing influence on the functions of organic life through the nervous system than by a local irritant action. When the latter is present it partakes of the character of gastro-enteritis. *The fatal quantity* varies widely, since ♏iij killed a child aged 13 months,† while recovery has followed after swallowing fʒj (a child*), and in adults fʒij,* fʒij† (without purging) and f℥j.‡ In cases of poisoning demulcents, as linseed-tea, must be given, and the stomach emptied.

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* *The Pharm. Journ. and Trans.*, 1883, p. 446.

† *Med. Times and Gazette*, I, 1870.

Physiological Effects.—*Rubbed on the skin*, croton-oil causes rubefaction and a pustular or vesicular eruption; and rubbed over the abdomen it will sometimes purge. The eruption ordinarily appears in a few hours and lasts about four days. Croton-oil, taken *internally*, is a powerful *hydragogue purgative*, occasionally increasing also the secretion from the kidneys. Gtt. j–ij are usually sufficient to produce active catharsis, but sometimes as much as gtt. viij–x may be taken without affecting the bowels. It operates very speedily, often causing evacuations in half an hour, and is apt to produce considerable sedation of the vascular system.

Medicinal Uses.—Croton oil, from the smallness of the dose required and the speediness of its action, is an extremely valuable purgative in *obstinate constipation*, as an hydragogue in *ascites*, and in cerebral disorders, particularly *hyperemia* and *apoplexy*. Its exhibition in the latter disease is indicated when the arterial tension is high and there is evidence of cephalic congestion, as manifested by an incompressible pulse and facial flushing. Cardiac failure is a contraindication to the use of croton oil in apoplexy. As a *counter-irritant*, it is often employed with advantage in pulmonary and laryngeal affections, diseases of the joints, etc. In *chronic laryngitis*, and *bronchitis*, it may be applied externally diluted with olive-oil upon a camel's hair brush about the throat or over the sternum.

Administration.—Dose, gtt. j–ij, made into pill with bread-crumb. For *external use*, it may be diluted with one or two parts of olive-oil or oil of turpentine.

MERCURIAL CATHARTICS.

The preparations of mercury employed as cathartics are *calomel* and *blue pill*. Their purgative effects depend partly on the increased flow of bile which they occasion, and partly on the stimulus which they give to secretion from the mucous follicles of the intestinal canal and from the pancreas. They probably do not increase the amount of bile secreted, but by irritation of the orifice of the duct, cause reflex contraction of the ducts and the gall-bladder, and consequently expulsion of that already secreted. They are rarely employed alone, owing to the slowness and uncertainty of their action, but are usually combined with or followed by other cathartics (as jalap, senna, rhubarb, compound extract of colocynth, or some of the saline preparations). The mercurial cathartics are usually administered with a view of combining a purgative action with an effect on the secretions, particularly that of the liver; also as anthelmintics and as revulsives in cerebral and other affections. They are well adapted to infantile cases, from the facility of their administration, and are especially beneficial in the ephemeral febrile attacks to which children are subject; they, moreover, rarely produce salivation in children.

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* "Handbuch der Toxicologie," Huseman, p. 443.

† *Am. J. Med. Sci.*, April, 1874, p. 416.

‡ *Boston Med. and Surg. Journ.*, 1868, p. 294.

Hydrargyri Chloridum Mite (*Mild Chloride of Mercury, or Calomel*). (Noticed at length under the head of *Alteratives.*) Dose, as a *cathartic*, gr. j–xij, in pill, powder, or it may be taken with syrup or molasses; to be followed, in from four to six hours, by some other cathartic. Sometimes, when it is exhibited with a view to a full action on the liver, gr. ¼–ij may be taken every hour or two until the whole purgative dose is taken; or it may be administered at bedtime, with an aperient draught the next morning, as a Seidlitz powder. For children, larger doses are required in proportion than for adults: gr. ¼–vj may be given to a child from three to six years old. Calomel occasionally causes griping pains in the bowels, with bilious vomiting; this is attributable, not to any irritant qualities in the medicine, but to the acrid character of the bile secreted. Calomel is an ingredient of the *compound cathartic pills.*

Massa Hydrargyri (*Mass of Mercury*), commonly called *blue pill* or *blue mass* (see *Alteratives*), is analogous in its cathartic action to calomel, but milder and less certain. It is given in about the same doses and in the same combinations, etc.

ENEMATA.

In cases of irritabillity of the stomach—or with the view of hastening the action of cathartics taken by the mouth—or to remove feculent accumulations in the lower bowels—or to relieve tympanites—or for the purpose of revulsion, or the removal of threadworms—or as astringents in intestinal fluxes, as emollients to soothe the lower bowel, or as restoratives, and finally as sedatives, *enemata* are frequently administered. They may be conveniently classified into *purgative*, *forced*, *anthelmintic*, *astringent*, *emollient*, *nutrient*, and *anodyne*.

1. Purgative Enemata.—When it is desired simply to open the bowels mechanically, as in *obstinate constipation*, *peritonitis*, etc., tepid water, flaxseed tea, or other demulcent infusion may be employed. The common *laxative enema* consists of a tablespoonful of common salt, molasses and lard-or olive-oil, each, in two-thirds of a pint of warm water; castor-oil or Epsom salt may be added to increase the cathartic effect. Senna-tea or some other cathartic infusion is often employed. Glycerin, f℥ss–j, with an equal quantity of water, injected into the rectum, will produce in a few minutes, an evacuation, usually normal in consistence. To relieve *flatulency*, oil of turpentine (f℥ss–j, in emulsion), or milk of asafœtida (f℥ij–iv) may be given. The latter is a suitable preparation in infantile cases.

2. Forced Enemata.—In some cases, as *intussusception* of the intestines, or even in *hernia*, much good may be accomplished by the gradual distention of the bowel by means of *forced enemata* of warm water. This is accomplished by means of a long flexible rubber-tube, one end of which is armed with a rectal tube having a blunt conical point and several large openings to admit of the free passage of the water. The other end of the flexible tube is attached to a large funnel, and the tube has a stop-cock upon it. By elevating the funnel and filling it with water, a continual stream can be thrown into the bowel, the force being regulated by the height at which the funnel is held and by the stop-cock. In this way from five to ten pints of water can be thrown into the bowel, filling the large intestine and even passing the ileo-cæcal valve. The injection should be conducted *slowly* and *carefully*. Several cases of intussusception have been reported where the symptoms subsided under this treatment, the invaginated portion of the intestine having slipped back to its proper place during the distention. This method should not be resorted to when there is reason to think that sphacelus of the bowel is taking place, as it might result in a rupture.

3. Anthelmintic Enemata.—For the removal of *thread-worms* infusion of quassia makes an excellent enema. For the same purpose injections of salt and water, oleum terebinthinæ f℥iv–vj with the yolk of an egg in a pint of tepid water, or lime-water alone, are serviceable remedies.

4. Astringent Enemata.—These are employed to arrest hemorrhage as in *hemorrhoids*, to cure *chronic dysentery* and *diarrhœa*,

to restrain muco-intestinal discharges, as in *proctitis*, and to heal *rectal ulcers*. Ice-cold water injections are employed against *hemorrhage*. Nitrate of silver gr. ij-v to water Oj, zinc sulphate, or alum gr. iv-viii to water Oj are suitable therapeutical measures for the relief of cases of dysentery and diarrhœa that have resisted other methods of treatment. The silver-enemata is also applicable to the healing of ulcers. For piles the decoctions of white oak-bark, geranium and hamamelis are applicable; in *chronic proctitis* silver nitrate gr. v–xx, water f℥i; or tannin gr. v–10 to water f℥; both to be introduced through a long tube.

5. EMOLLIENT ENEMATA—These are employed to relieve inflammation and irritability of the rectum and lower bowel. For this purpose decoctum lini, mucilago ulmi, decoctum cetrariæ and decoctum chondri are used. They are besides nutritious, particularly the two last.

6. NUTRIENT ENEMATA—In cases of exhaustion and hemorrhage as in *scirrhus of the pylorus*, *gastro-intestinal dilatation*, *gastric ulcer*, *gastritis*, the following substances may be injected daily as restoratives, viz., beef-tea ℥iv-viij with HCl ♏x and glycerole of pepsin ʒij, defibrinated blood (see p. 75); milk and gruel; beef-tea and brandy. Pancreation may be advantageously added to the above, and if the injection be intolerant, a little laudanum.

7. ANODYNE ENEMATA—These are administered in painful affections of the rectum, bladder, vagina and urethra as follows; laudanum fʒ¼-j; tinctura belladonnæ gtt. xv-xxx; cocaine gr. ¼-j, to water f℥ij-iv.

ORDER III.—DIAPHORETICS.

Diaphoretics (from διαφορέω, *I transpire*), called also *sudorifics*, are medicines which promote transpiration from the skin. The action of the cutaneous exhalants may be increased by various means. The mere introduction of a large quantity of fluid into the system will produce sweating, if the system be kept warm. Exercise, and a warm temperature, by determining a flow of blood to the cutaneous vessels, act in the same way. Nauseants occasion diaphoresis by relaxing the orifices of the cutaneous vessels; stimulants, by exciting them to increased secretion. Diaphoretics are employed therapeutically for their evacuant, revulsive and alterative effects, and to promote absorption. Different classes of diaphoretics are required for different morbid conditions.

1 NAUSEATING DIAPHORETICS.—Most of the *emetics* in nauseating doses, produce a powerfully relaxing diaphoretic action, and are much employed, with this view, in inflammatory cases, when not contraindicated by the presence of gastric irritability. The PREPARATIONS OF ANTIMONY (q. v.) and IPECAC (q. v.) are chiefly resorted to as nauseating diaphoretics. Ipecac is often given as a diaphoretic, in combination with opium, in the form of *Dover's Powder* (see p. 89).

2. REFRIGERANT DIAPHORETICS.—The saline and ethereal preparations classed as *refrigerants* (q. v.), produce a gentle relaxing diaphoretic action, unattended with nausea. They are used to allay febrile excitement and reduce the temperature of the body.

3. STIMULATING DIAPHORETICS.—This group includes the diffusible stimulants, aromatic substances generally, of every class, and many narcotics, particularly opium and camphor. They are contraindicated in high inflammation, but are very serviceable in rheumatic and pulmonary affections, after vascular excitement has been reduced, and in all diseases where the surface of the body is cold. *Opium*, in the form of *Dover's Powder*, may be employed in inflammatory cases, where other stimulating diaphoretics are inadmissible, and is given with advantage in an early stage of acute rheumatism, dysentery and catarrh of the air passages, unless the action of the pulse be very strong, when this should be previously moderated. The operation of the diaphoretic stimulants is promoted by the free use of warm diluent drinks, and warm covering to the body.

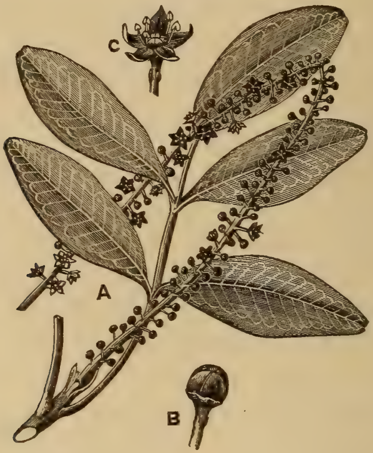
PILOCARPUS.

Pilocarpus is the LEAFLETS of Pilocarpus pennatifolius (*Nat. Ord.* Rutaceæ), a shrub of some of the northern provinces of Brazil, growing to the height of about five feet, with a long cylindrical root, about three-quarters of an inch in thickness, and imparipinnate leaves (with anastomosing veins near the margin) about nine inches long, with from three to five pairs of opposite, oblong-lanceolated, grayish-green leaflets, with an odd terminal one, which are dotted with a number of pellucid glands. There are several plants known in South America under the name of Jaborandi, and the variety brought here is from Pernambuco. The *leaflets* have a characteristic odor (resembling a mixture of Indian hemp, matico and cubebs) and a warm, sharp, aromatic taste.

CHEMICAL CONSTITUENTS.—They yield *pilocarpine* ($C_{11}H_{16}N_2O_2$), an alkaloid of a bitter, nauseous, astringent taste, soluble in water, alcohol, ether, chloroform and diluted acids, and an amorphous alkaloid termed *Jaborine*[*]—probably a derivative of pilocarpine—has been isolated, which resembles atropine in action; they contain also a *volatile oil* (chiefly pilocarpine, $C_{10}H_{16}$). Recently MM. Hardy and Calmels[†] have obtained pilocarpine synthetically from a derivation of pyridin, which is stated to be identical in action with the natural base.

Incompatibles.—Tannic acid, the caustic alkalies, the ferric and metallic salts.

Fig. 44.



PILOCARPUS PENNATIFOLIUS. A, LEAF; B, C, FLOWERS.

Aids.—As a diaphoretic, sarsaparilla and mezereum; upon the heart by aconite, veratrum viride, etc.

Contraindications.—Pilocarpus should not be given in affections of the gastro-intestinal mucous membrane, nor in weak heart due to disease of the cardiac muscle or ganglia, or of the valves.

Physiological Effects.—The action of pilocarpus and of its alkaloid (upon which its effects depend) has been studied by Ringer,[‡] Murrell, Langley,[§] Harnack and Meyer (*loc. cit.*) and many others, with the following results. It paralyzes the vaso-motor nervous system, and rapidly excites the circulation, but the pulse is soon slowed and the arterial tension is greatly diminished. According to Ringer (*loc. cit.*), it paralyzes the ventricles separated from the auricles by a direct action. The temperature, as a rule, rises at first, but coincident with the profuse sweating, is lowered. It is a powerful diaphoretic, augmenting both the watery and solid ingredients of the sweat enormously, probably by a direct action on the peripheral endings of the nerves. The amount of urea eliminated by the skin is especially heightened. The sweat is said to be acid at first, becoming neutral and, finally, alkaline. It also causes salivation, which is sometimes very profuse, in which case the diaphoretic effect is less marked, and *vice versa.* The sialagogue effect probably depends on a direct action of the drug upon the glands. The gastric and bronchial secretions are also increased. These effects continue for from three to six hours. Disturbance of the vision, contracted pupils, cerebral uneasiness, and after a time, vomiting, generally accompany these eccritic results, which effects are often followed by drowsiness. In much of its action, especially on the secretions, an antagonism exists between pilocarpus and belladonna (Langley, *loc. cit.*). Pilocarpus appears to stimulate the nutrition of the hair, and in one case, Prentiss,* under its use, noticed a change in the color of the hair from blonde to black. Galezowski † found that an aqueous solution of pilocarpine nitrate applied to the conjunctiva contracted the pupil. It is eliminated by the secretions on which it acts.

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[*] *Arch. für exper. Pathol. u. Pharmakol.*, XII, p. 366; Harnack und Meyer.

[†] *Compt. Rend.* CII, quoted in *Dublin M. J.*, Dec., 1887.

[‡] *Practitioner*, 26, 1881, p. 5.

[§] *Journ of Physiology*, 1878, p. 339.

MEDICINAL USES.—In cases of *pleuritic effusion*, especially after the subsidence of the inflammatory symptoms, pilocarpus or its alkaloid often quickly removes the transudation. In the *renal dropsy* and *uremia* of *chronic Bright's disease* it is frequently invaluable on account of its diaphoretic effects and because it increases the elimination of urea by the skin. It has also been used with success in *puerperal eclampsia* due to kidney disease, in *humid asthma* and *bronchorrhœa*, in some cases of *mumps*, in *chronic enlargement* of the cervical glands, in *adenitis* of the inguinal glands, and as a *galactagogue.* Pilocarpine has been found useful in arresting severe and prolonged *hiccough*, in doses of gr. ¼ hypodermically employed. It is recommended in *diabetes insipidus* and in squamous affections of the skin, as *phthiriasis* and *psoriasis*, and has been used locally and hypodermically with advantage in *alopecia.* In *diphtheria* it has been given with varying success, but on the whole the evidence can scarcely be considered in favor of its employment. By reason of its diaphoretic action it is one of the remedies used in *anidrosis.*

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* *Phila. Med. Times*, July 2d, 1881.

† *Comptes Rendus de la Société de Biologie*, 4, 1877, p. 401.

Administration.—Dose of the *fluid extract,* fʒss–j; of *pilocarpine hydrochlorate,* gr. ⅛–ss. Children bear proportionally large doses.

ALTERATIVE DIAPHORETICS.

Under this head are comprised a class of diaphoretic medicines which produce a gradual and nearly insensible increase of the cutaneous secretion, and are supposed to promote the elimination of noxious matters from the blood through the vessels of the skin. They are employed chiefly in chronic rheumatic and cutaneous affections, and in secondary syphilis.

SARSAPARILLA.

The name of Sarsaparilla is applied to the root of Smilax officinalis, S. medica and other species of Smilax (*Nat. Ord.* Smilaceæ), twining prickly shrubs of Mexico, Guatemala and the warm countries of South America.

Description and Varieties.—The roots consist of numerous wrinkled, slender pieces, of the average thickness of a writing-quill, several feet long, springing from a common head or rhizome, and are frequently found in the shops with portions of the stem attached. Several varieties are known: 1. *Honduras sarsaparilla,* the most common variety in the United States, is composed of several long, thin roots, folded lengthwise, of a dirty grayish or reddish-brown color. 2. *Jamaica sarsaparilla,* which comes in shorter bundles, and is known by the red color of the epidermis. 3. *Vera Cruz sarsaparilla* consists of a head with numerous long radicals. 4. *Brazilian* or *Rio Negro sarsaparilla* is found in cylindrical bundles, with fewer rootlets than the Honduras variety; it is distinguished by the amylaceous character of its interior structure. 5. *Guatemala sarsaparilla* resembles Brazilian.

Sarsaparilla roots are several feet in length, about the thickness of a goose-quill, cylindrical, more or less wrinkled longitudinally, and consist of a whitish-brown or pink cortical portion covered with a thin, gray, brown or red epidermis, and inclosing a layer of whitish ligneous fibre and a central pith. The *cortical portion* is more active than the interior portion; the central medulla contains a good deal of starch. Sarsaparilla, in the dried state, is nearly inodorous, but its decoction has a strong smell. It has a mucilaginous, slightly bitter taste, and when chewed for some time produces a persistent acrid impression on the mouth; this acridity of taste is the criterion of good sarsaparilla.

Chemical Constituents.—Water and diluted alcohol extract its virtues. It contains three homologous * glucosides, resembling saponin, called *smilacin*, *parallin* and *sarsasaponin*, a *volatile oil*, etc. The Vera Cruz and Jamaica varieties contain the most smilacin, and are therefore the best for medical purposes.

Aids.—Guaiac, mezereum and pilocarpus.

Effects and Uses.—The physiological effects of sarsaparilla, which depend on its glucosides, beyond an increase in the flow of the secretions, are not very obvious; in large doses it produces nausea, vomiting, diarrhœa and salivation. Its efficacy in eradicating various morbid symptoms is believed in by some, though denied by others; and its mode of action, which resembles the mercurials in certain points, is popularly attributed to a purifying influence on the blood through the function of the skin. *It is employed* in *secondary* and *tertiary syphilis*, particularly where the disease resists or is aggravated by the use of mercury; also in *chronic rheumatism*, skin-diseases, as *eczema pustulosum*, and *cachectic conditions* of the system generally.

Administration.—Dose, of the powder, ʒss three or four times a day—never used, however, in this form. The *compound decoction* is made by boiling sarsaparilla 10 parts, sassafras, guaiacum wood and liquorice root each 2 parts, and mezereon 1 part, in 100 parts of water, then macerating, and, after straining, adding water enough to make the decoction measure 100 parts: dose, f℥iv–vj t. d. The *compound syrup* (which contains also guaiacum wood, pale rose, senna, glycyrrhiza, sassafras, anise, and gaultheria) is a favorite preparation; corrosive sublimate should not be given with it, as it is decomposed, it is said, into calomel. Dose. f℥ss. Of the *fluid extract*, the dose is fʒss. The *compound fluid extract* contains the ingredients of the compound decoction, except the guaiacum; dose, f℥j, repeated.

GUAIACI LIGNUM—GUAIACUM WOOD.
GUAIACI RESINA—GUAIAC.

Guaiacum Wood, or *Lignum Vitæ*, and Guaiac are products of

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* *Dissert. Inaug. Dorpat*, 1892, Schultz, quoted.

Guaiacum officinale and G. sanctum (*Nat. Ord.* Zygophyllaceæ), large evergreen trees of South America and the West Indies. The wood, which is remarkable for its hardness and density, is imported in logs or billets, covered with a thick gray bark; the outer portion or sap-wood is of a pale-yellow color, the inner of an olive-brown. The HEART-WOOD is the official portion; it is usually kept in the shops in the state of shavings or raspings; they are inodorous unless heated, and when chewed for some time they have a bitterish pungent taste. Guaiacum wood yields its virtues to alcohol, and partially to water; they depend on the guaiac contained in the wood.

PREPARATION AND CHEMICAL CONSTITUENTS.—Guaiac is a peculiar RESIN, obtained from Guaiacum officinale by spontaneous exudation, by incision, by dry heat, or by decoction of the comminuted wood. It comes in large, irregular, semi-transparent, brittle pieces, of varying size—externally of a deep green or olive color, and internally red. It has a slight balsamic odor, which is rendered stronger by heat, and though at first nearly tasteless, leaves a hot, acrid sensation in the mouth and throat. Water dissolves it partially, alcohol completely. It contains *guaiaconic* and *guaiaretic acids*, *guaiac beta-resin*, *gum*, *ash*, *guaiacic acid*, *coloring matter*, etc. (Hadelich*). Most oxidizing agents, as nitric and chromic acids, etc., produce a blue, then green, and finally a brown color, with tincture of guaiacum.

INCOMPATIBLES.—Spirit of nitrous ether and the mineral acids; water decomposes the resin. Oxidizing agents produce a play of colors with the tincture.

AIDS.—Sarsaparilla, mezereum, and pilocarpus.

EFFECTS AND USES.—Guaiacum wood and guaiac are stimulant *diaphoretics*, also increasing the secretion of the bronchial mucus, and in large doses, cathartic. They are principally *used* for their alleged alterative virtues in *chronic rheumatism*, *rheumatic arthritis*, and skin diseases; guaiac has been used as a laxative. In *acute tonsillitis* the tincture, fʒ½, repeated every three or four hours, is extremely useful. They are considered also to possess emmenagogue properties, and are employed in *amenorrhœa* and *dysmenorrhœa*.

ADMINISTRATION.—*Guaiacum wood* is used only as an ingredient in the compound decoction and syrup of sarsaparilla. Dose of *guaiac*, gr. x-xxx, in pill or emulsion, sometimes combined with alkalies. The *tincture* (20 parts in 100 parts of the tincture) and

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* "Pharmacographia," 2d ed., p. 104, quoted.

ammoniated tincture (20 parts to aromat. sp. of ammonia q. s. to make 100 parts) are much used in chronic rheumatism; the former is given also in amenorrhœa; dose, f℥j t. d. They are decomposed by water, and should be administered in mucilage, syrup or milk, or emulsified with acacia.

MEZEREUM.

Mezereum is the BARK of Daphne mezereum and other species of Daphne (*Nat. Ord.* Thymelaceæ), European shrubs which grow to the height of four or five feet. The root-bark is the part employed in Great Britain, but the bark of our shops, which is brought from Germany, is the stem-bark. It comes in strips from two to four feet long and an inch or less in breadth, folded in bundles or wrapped in the shape of balls. It has a thin grayish or reddish-brown, wrinkled epidermis and a tough, pliable, whitish inner bark. When fresh it has a faint, nauseous smell, but when dry is nearly inodorous. Its taste is at first sweetish, afterward highly acrid.

CHEMICAL CONSTITUENTS.—It yields its virtues to water and alcohol, and contains a neutral crystalline bitter glucoside, called *daphnin* ($C_{31}H_{34}O_{19}$), and a *resin*, to which it owes its acridity.

INCOMPATIBLES.—Tannic and free acids precipitate the glucoside. The resin is insoluble in water.

AIDS—Sarsaparilla and guaiac.

TOXICOLOGY.—Christison* records a case of fatal poisoning in a child of 8 years by mezereon, but the quantity taken is not mentioned.

EFFECTS AND USES.—The *topical* action of mezereum is irritant and vesicant. When swallowed in large quantities it is highly acrid; in medicinal doses it promotes the action of the secreting and exhaling organs, particularly of the skin and kidneys.

It is *employed* chiefly in conjunction with sarsaparilla, (in the compound decoction, etc.) as an alterative diaphoretic in *rheumatic syphilitic* and *cutaneous affections*. As a *masticatory*, it has been chewed for the relief of paralysis of the muscles of deglutition.

ADMINISTRATION.—The *fluid extract* is the best preparation for internal administration; dose, ♏x. An *extract* is also official, and is given as an addendum to rubefacient liniments and ointments. The *ointment* is also used as a stimulating application to indolent *ulcers*. Mezereum is rarely employed nowadays.

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* "A Treatise on Poisons," 4th ed., p. 601.

MENISPERMUM.

Menispermum is the RHIZOME and ROOTLETS of Menispermum canadense, Yellow Parilla or Canada Moonseed (*Nat. Ord.* Menispermaceæ), a climbing plant of North America. The rhizome contains *berberine*, *starch*, etc. It is supposed to be a diaphoretic, diuretic, tonic and alterative, and to possess virtues similar to those of sarsaparilla, and it may be given in corresponding doses. According to the experiments of Rutherford, it is an intestinal, but not an hepatic, stimulant. There are no official preparations.

CALENDULA.

Calendula is the FRESH FLOWERING HERB of Calendula officinalis, or Marigold (*Nat. Ord.* Compositæ), a European plant, cultivated in our gardens. It contains a *volatile oil*, a *bitter-principle*, *calendulin*, etc. It is supposed to be stimulant, alterative, diaphoretic, and diuretic. It is said to be efficacious in certain forms of chronic *vomiting*, and *externally* it is prescribed to promote resolution of *ulcers* and *wounds*. It may be given in doses of gr. viij–ʒj. Of the *tincture*, the dose is fʒss–j. It may be used *externally*, diluted with water 20 parts.

SASSAFRAS.

This is the BARK of the ROOT of Sassafras officinale (*Nat. Ord.* Lauraceæ), an indigenous tree of middling size. The bark is found in the shops in small, irregular pieces, of a cinnamon-color, sometimes invested with a brownish epidermis. It has a highly fragrant odor and a sweetish, aromatic taste. Its virtues are extracted by water and alcohol, and it contains a little *tannic acid* and a *volatile oil* (*oleum sassafras*).

EFFECTS AND USES.—Sassafras bark is a mild stimulant alterative diaphoretic, used chiefly in combination with sarsaparilla. Its principal virtues are probably aromatic. Dose of the *oil*, gtt. ij–x. (For *Sassafras Fith*, see *Demulcents*.)

STILLINGIA.

The ROOT of Stillingia sylvatica (*Nat. Ord.* Euphorbiaceæ), commonly called *Queen's Delight*, a perennial plant growing to the height of two feet in our south Atlantic States. Its active principle has not been isolated.

Effects and Uses.—The juice of the plant possesses a biting pungent taste, which, when swallowed excites a feeling of warmth in the stomach. It augments the secretions of the gastro-intestinal tract, particularly the liver, also the urinary flow, and in full doses nauseates and purges. It is highly esteemed by southern physicians as an alterative diaphoretic in *secondary syphilis*, *scrofula*, cutaneous affections and *chronic rheumatism*.

Administration.—Dose of the powder, gr. xv-xxx. The *fluid extract* may be given in the dose of fʒss. A decoction and tincture are extemporaneously prepared.

ORDER IV.—DIURETICS

Diuretics (from διά, *thoroughly*, and οὐρέω, *I make water*) are medicines which excite the secretion of the urine. The flow of urine may be promoted *indirectly* by increasing the quantity of fluid taken into the stomach, or by the removal of causes which check its secretion, or by mental emotion, a cool temperature, etc. It is promoted *directly* by the use of medicinal agents which specifically affect the kidneys; they are termed diuretics. A large proportion of diuretic medicines are found among the agents which influence other secretions, particularly *diaphoretics*. The functions of transpiration and urination are to some extent vicarious, and the same articles will prove diaphoretic or diuretic, as their action may be directed to the skin or kidneys. External warmth and warm drinks determine the action of such medicines to the skin; and, on the other hand, if the skin be kept cool, and cool diluents freely administered, the secretion from the kidneys is promoted.

Blennorrhetics, or medicines which have a special action on the mucous membranes, exert also a diuretic influence—probably the result of the stimulating impression which they make on the mucous membrane of the urinary passages. When the action of the kidneys is obstructed by diseases of the heart, *sedatives* prove diuretic, by their tranquillizing influence on the action of the heart. In cases of obstruction of the portal system, *mercurials* increase the efficacy of the diuretics proper; and also *cathartics*, by stimulating the flow of bile and the pancreatic juice.

The principal *therapeutic* employment of diuretics is *to promote the absorption of dropsical effusions*. They are also useful in nephritic disorders attended with obstructed secretion; to wash out calculi from the pelvis of the kidneys, ureters and bladder; in gravel, with the view of rendering the urine more dilute; and they may be resorted to as evacuants, to reduce inflammation.

As diuretics act by becoming absorbed, they should be administered in a very diluted state, to prevent a cathartic effect.

The following groups of medicines, noticed under other heads, are employed also as diuretics:—

1. *The Saline and Ethereal Refrigerants* (see p. 255).

2. *The Alkaline Carbonates* (see *Antacids*); and the *Alkaline Salts which contain a vegetable acid*, as the acetates, citrates and tartrates. The acid potassium tartrate, or CREAM OF TARTAR (see p. 346), is a very active diuretic.

Potassii Acetas (*Potassium Acetate*). *This salt* ($KC_2H_3O_2$), formerly termed *sal diureticus* from its decided diuretic action, is made by saturating acetic acid with potassium bicarbonate. It occurs, when pure, as a white, foliaceous, satiny mass, of a warm, pungent taste, very deliquescent, and wholly soluble in water and alcohol. The physiological effects of the potassium compounds have already been fully considered (see p. 253). In small doses it is *diuretic*, and in larger doses *gently cathartic.* It is a good deal employed as a *diuretic* in *dropsies*, to cleanse the kidneys of deleterious matters in *pyelonephritis*, as an *antacid* in *acute rheumatism*, as a preventive of the formation of *uric acid calculi*, and it has also been found useful as an alterative in *cutaneous affections.* As is the case with all the alkaline salts containing vegetable acids, the acidulous radical of this salt is decomposed in the system into carbonic acid. Although increasing the flow of urine, potassium acetate diminishes the amount both of uric acid and of urea in the secretion. Hence, it is valuable in *gout*, and, like colchicum, it may perhaps check the actual formation of uric acid in the system. Dose, gr. xx–ʒj, repeated.

Sodii Acetas (*Sodium Acetate*) ($NaC_2H_3O_2.3H_2O$), is prepared from crude pyroligneous acid, which is saturated with cream of lime, and the solution of calcium acetate thus formed is decomposed by sodium sulphate; repeated solution and crystallization, with fusion, furnish a pure salt in the form of white or colorless striated prisms, which effloresce in dry air, are wholly soluble in water, tolerably soluble in alcohol, and have a sharp, bitterish, not disagreeable taste. Its effects and uses are *analogous* to those of potassium acetate, over which it has the advantatage of not being deliquescent. Dose, gr. xx–ʒj, p. r. n.

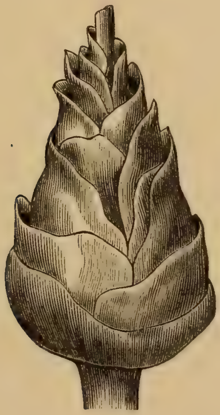
3. *Sedatives* (see p. 235); and DIGITALIS (see p. 277), which is very much employed in *cardiac* dropsies in combination with squill.
4. *Blennorrhetics* (see index), particularly the OLEO-RESINS.
5. Most of the *Stimulating Diaphoretics.*

SPECIAL DIURETICS.

SCILLA—SQUILL.

Squill is the sliced BULB of Urginea Scilla (*Nat. Ord.* Liliaceæ), a perennial plant which grows on the shores of the Mediterranean. It has fibrous roots attached to a roundish-ovate bulb, from which both the leaves and flower-stem spring directly, the latter appearing first; the leaves are broad, lanceolate, and from twelve to eighteen inches long; the stem is about two feet high, and bears pale yellowish-green flowers.

FIG. 45.



URGINEA SCILLA, BULB.

The fresh bulb is pyriform, of the size of a fist to that of a child's head, and consists of thick, fleshy, concentric scales, attenuated at their edges, and attached to a rudimentary stem; the outer scales are very thin and papery. Two kinds of squill bulbs are met with, the *white* and the *red*, which differ only in the color of their scales, and are identical in medicinal virtues. Both abound in a viscid, acrid juice, which is very much diminished by drying, with little loss of medicinal power. For importation, squill is usually sliced and dried, and is found in the shops in white or yellowish-white pieces, which when dry are brittle, but when moist, flexible. They absorb moisture readily, and should be kept in well-stoppered bottles. They have a feeble odor, a bitter, nauseous, acrid taste, and yield their virtues to water, alcohol and vinegar.

CHEMICAL CONSTITUENTS.—The active principles found in squill are *scillipicrin*, *scillitoxin*, and *scillin*. The first two are said to act on the heart like digitalis, slowing the pulse by stimulating the end-organs of the par vagum, and the last to produce numbness and vomiting. A principle termed *scillaïn* is described by Jarmersted,[*] which he ascertained to be poisonous to the heart-muscle.

AIDS.—As an expectorant, senega and tartar emetic; digitalis promotes its diurectic action.

PHYSIOLOGICAL EFFECTS.—In small doses, squill promotes secretion from the mucous membranes and the kidneys—its diuretic effect being much the most marked and constant. Hammond[†] found that in addition to its diuretic action, it increased also the proportion of inorganic solids. Husemann states that the diuretic effects of squill are due to its influence on the food-pressure, which it increases; but clinical experience teaches that it stimulates the kidneys. In large doses it excites nausea, vomiting, and occasionally purging.

TOXICOLOGY AND ANTIDOTES.—In excessive doses it acts as an acro-narcotic poison, gr. xxiv[‡] having proved fatal. The symptoms are violent vomiting and purging, abdominal pains, bloody or suppressed urine, reduction of the pulse, with collapse; or death may be preceeded by convulsions. Christison[§] describes an instance in which a teaspoonful of the root killed a woman, the chief symptoms being gastric pain and convulsions. The stomach was found to be inflamed everywhere, and partly eroded. After evacuation of the stomach, opiates and demulcents are to be administered, and, if syncope or collapse occur, alcoholic stimuli should be given.

MEDICINAL USES.—Squill is employed principally in the treatment of *dropsy;* it should not be used, however, in cases complicated with degeneration of the kidneys or inflammation of the bladder. Digitalis is much prescribed in combination with squill in the treatment of cardiac dropsies, and calomel is often added with a view to its action on the absorbents. As a *blennorrhetic expectorant,* squill is an excellent remedy in *chronic* and *acute bronchial affections ;* it is, however, improper in the early stages of inflammatory cases. As an *emetic,* squill is too dangerous for general use; but it forms an ingredient in some emetic preparations administered in *croup.*

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[*] *Arch. für exper. Pathol. u. Pharmak.*, XI, p. 22.

[†] *Am. Journ. Med. Sci.*, 1859, p. 275.

[‡] "Handbuch der Toxicologie," p. 413.

[§] "A Treatise on Poisons," 4th ed., p. 879.

Administration.—Dose, as a *diuretic* or *expectorant,* gr. j, repeated and gradually increased till nausea supervenes. Grains vj–xij will induce emesis. Of the *vinegar* (*acetum scillæ,* containing 10 per cent. by weight of the powder), the dose is ♏xv to fʒij; of the *fluid extract,* ♏j; of the *syrup,* fʒj; of the *compound syrup,* known as *hive syrup* (which contains a solution of senega and squill in diluted alchohol and water, and tartar emetic, gr. j in every ounce of the syrup), ♏v–fʒj, according to the age; of the *tincture,* ♏v–xxx; the last three are excellent preparations in the latter stages of *acute bronchitis.*

COLCHICUM.

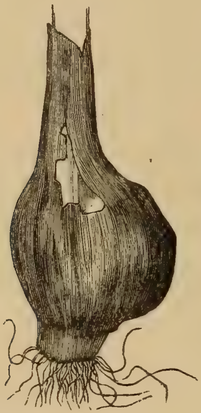
Colchici Radix, Colchicum Root; Colchici Semen, Colchicum Seed.

Colchicum autumnale, or Meadow-Saffron (*Nat. Ord.* Melanthaceæ), is a small biennial, bulbous plant, which grows wild, in moist meadows, in England and other temperate parts of Europe. The bulb, or corm, appears in midsummer as the lateral offset from the corm of the preceding year, and sends up the flower-stem in the autumn—the leaves and fruit following in the succeeding spring. The leaves are broadly lanceolate, about five inches long; the flowers, of a lilac or light-purple color; and the fruit, oblong, elliptical and three-celled.

Description.—The corm and seed are the portions used medicinally. The corms are gathered in July, just before the sprouting of the flower from the young corm. They are somewhat like tulip-bulbs in appearance, but solid, and not composed of scales. They are covered by an external brown membrane and an inner reddish-yellow one, and are an inch and a half to two and a half inches in length, with a longitudinal groove. Internally they are white, fleshy and solid, and contain an acrid, bitter, milky juice. As found in the shops they are in the dried state, sometimes whole, but usually cut into transverse slices, about an eighth of an inch thick, with a notch on one side, and deprived of the outer brown membrane. They have a hircine odor and a bitter, hot and acrid taste. The seed are brown, about the size of black-mustard seed, inodorous, and have a bitter, acrid taste; they are less apt to be injured by drying than the corm.

CHEMICAL CONSTITUENTS AND TESTS.—Colchicum corm and seed yield their virtues to vinegar and alcohol; they both contain an alkaloid, soluble in water, readily so in alcohol, but insoluble in ether, termed *colchicine* ($C_{23}H_{27}NO_7$, Laborde et Houdé), on which the medicinal activity depends. *Colchicine* ($C_{46}H_{27}NO_{14}$) is a crystalline substance, of feeble acid reaction, which does not preëxist in the plant, but is formed by the action of the mineral acids upon colchicine. *Tests.*—Colchicine makes with concentrated nitric acid a play of colors, beginning with yellow, then green, afterward crimson, and finally violet; with concentrated sulphuric acid, to which has been added a fragment of potassium nitrate; it produces an intensely yellow color terminating in light violet.

FIG. 46.



COLCHICUM AUTUMNALE, BULB.

INCOMPATIBLES.—Tannic acid, and the vegetable infusions containing it, form a partly insoluble tannate with colchicine.

AIDS.—Squill; also the purgatives, and diuretics, as colocynth and digitalis.

PHYSIOLOGICAL EFFECTS.—Colchicum is a *local* irritant. Colchicine is undoubtedly the active ingredient of meadow-saffron (Huseman*), and when introduced by the stomach diffuses into the blood, since it has been found in the heart, lungs, liver, kidneys and blood by Aschoff.* Other observers, however (Laborde et Houdé†) failed to detect it there or in the heart, even after intravenous injection, but found the largest quantity inside the stomach and intestines. It seems to expend its force on the alimentary tract, though not entirely by a local action, for both Lewins‡ and Roy§ found these parts to be much inflamed after the subcutaneous administration of the drug. Taken *internally*, in small doses, it stimulates the secretions generally; in larger doses it produces nausea, vomiting,|| and repeated purging, and primarily acceleration, followed by a reduction in the frequency of the pulse; in excessive doses it is an intestinal irritant poison, inducing emesis, uncontrollable diarrhœa, collapse, and finally destroying life by paralysis of respiration, the heart beating for a short time after the cessation of this act; the cerebral functions usually remain unaffected, though Toulmouche (*loc. cit.*) states that there is decided cerebral excitement. According to the recent investigations of Laborde et Houdé (*loc. cit.*) colchicine is without action on the centres of intelligence or volition, and there is an entire absence of paralysis, either motor or sensory, of central origin. The temperature falls during the period of emetocatharsis; and when injected into dogs there is a marked fall in the blood-pressure. The amount of urea and uric acid excreted in the urine is much increased after the administration of colchicum. Lewins (*loc cit.*) found the urea to be almost doubled. Hammond¶ experimentally ascertained that it heightened the urinary flow and the proportion of solids, but as his results were based on only three analyses they can scarcely be accepted as conclusive. It increases the secretion of the bile, which at the same time is rendered very watery. Although placed among the diuretics colchicum does not evince a more decided action on the kidneys than on other secretions, as those of the skin, liver, and mucous membranes.

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* "Die Pflanzenstoffe," 1871, p. 497.

TOXICOLOGY.—Dr. Major** reports 17 cases of poisoning by the wine of colchicum seeds, seven of which were fatal, the quantity ingested ranging from f℥iij–viij; in two, there were convulsions.

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* "Die Pflanzenstoffe," 1871, p. 499, quoted.

† Pamphlet, 1887. "Le Colchique et la Colchicine."

‡ *Edinburgh Med. and Surg. Jour.* LVI, p. 185.

§ *Arch. de Physiol. Norm. et Pathologique*, *t.* V, p. 648.

|| *Arch. Gén. de Médecine*, *t.* XVIII, p. 37, par. A. Toulmouche.

¶ *Amer. Journ. Med. Sci*, 1859, p. 275.

** *Canada Med. and Surg. Jour.*, 1874, p. 24.

Dr. G. B. Wood[*] states that fʒiiss of the wine of the root proved fatal, and in another instance f℥iss[†] of the wine of the bulb killed a man. Vomiting and purging are the chief symptoms of colchicum poisoning, convulsions being infrequent, while the brain escapes till the approach of death. After death, in Roy's (*loc. cit.*) experiments upon dogs, the post-mortem appearances were those of enteritis.

Antidotes.—Tannic acid is a partial antidote (forms a white precipitate with colchicine); emetics if required, and opiates, demulcents and stimulants are to be given.

Medicinal Uses.—Colchicum has long enjoyed a high reputation in the treatment of *gout;* and, although its *modus medendi* is obscure, it is universally admitted to possess a more decided control over the disease than any other remedy. It is usually administered in repeated doses till an effect is produced on the bowels, though purging does not promote its curative effect. Epsom salts and magnesia are often combined with it, as in the celebrated *Scudamore's draught* (*magnesia*, gr. xv-xx; *magnesium sulphate*, ʒj-ij; *wine of colchicum seed*, fʒj-ij, in any pleasant vehicle). An excellent combination in the treatment of gout is colchicum (*wine of the seed*, fʒj), with potassium iodide (ʒij), dissolved in cinnamon-water (f℥viij); dose, f℥ss t. d. until purgation is produced. Quinine and digitalis are also often given advantageously, with colchicum, in gout.[‡] When it is desired to act on the kidneys and skin rather than the bowels, opiates are sometimes added. It is better to reserve colchicum for the treatment of the acute paroxysms of gout, giving a little opium (as in Dover's powder) at night, particularly to relieve the pain and procure sleep, enjoining perfect rest and quiet and using warm applications locally. In *chronic gout* and in the *uric acid diathesis* colchicum is not as useful, and these conditions are better treated by a properly regulated diet, avoidance of stimulants, exercise in the open air and the administration of the alkalies, particularly of the lithium salts. In *rheumatism* it is also employed, but it has little control over this disease. Dr. Woodbury,[§] however, has reported cases where the hypodermic injections of ♏v of a solution of colchicine ($\frac{1}{10}$ per cent.) gave speedy and permanent relief in *acute rheumatism*, after the salicylates had failed.

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[*] "U. S. Dispensatory," 15th ed., p. 1534.

[†] *Edinburgh Med. and Surg. Journ.*, XIV, p. 262.

[‡] Lartigue's celebrated *gout-pills* are: acetic extract of colchicum root, 2 grains; extract of digitalis, 1 grain; compound extract of colocynth, 20 grains, to be mixed and divided into five pills—one to be taken at night.

[§] *Phila. Med. Times*, Dec. 2d, 1882.

It has been occasionally resorted to as a diuretic in *dropsy*, as a sedative in febrile and inflammatory diseases, and as an expectorant.

Administration.—Dose of the corm or seed, in powder, gr. ij-viij; the seeds are to be preferred. The liquid preparations, which are more generally used than the powder, are; the *wine of the root* (*vinum colchici radicis*), ♏x-xxx; *wine of the seed* (*vinum colchici seminis*), dose. fʒss-j; *tincture* (of the seed), dose, fʒss-j. An *extract of the root* (acetic) is also employed—dose, gr. j-ij; and a *fluid extract of the seed* and also *of the root*—doses, gtt. iv-xij. The alkaloid *colchicine* (not official) has been recommended as the best form of administration in doses of gr. $\frac{1}{50}$ in pill, or somewhat less by hypodermic injection.

OLEUM ERIGERONTIS—OIL OF ERIGERON.

The *oil distilled* from the fresh flowering *herb* of Erigeron canadense, or Canada Fleabane (*Nat. Ord.* Compositæ), an herbaceous indigenous plant, two or three feet high, with ovate or lanceolate toothed leaves, and white, blue or purple flowers. The oil by distillation yields *resin* and *terpene* ($C_{10}H_{16}$—Power *).

Effects and Uses.—It possesses *diuretic* and hemostatic properties, and has been used in *hemorrhagic dysentery* and *uterine hemorrhage*. It has been given in *gonorrhœa* with success, Stark † stating that in the majority of cases it stopped the discharge in from two to six days. Prettyman ‡ reports unvarying success with it in 50 cases, affirming that it cures in from six to eight days, but as he omits the details of treatment, his statement cannot be accepted as proven. Dose, gtt. v-xx, on sugar, or in capsule.

APOCYNUM.

Apocynum cannabinum, or Canada Hemp (*Nat. Ord.* Apocynaceæ), is an indigenous herbaceous plant growing to the height of two or three feet, with oblong-ovate leaves and small greenish, campanulate flowers.

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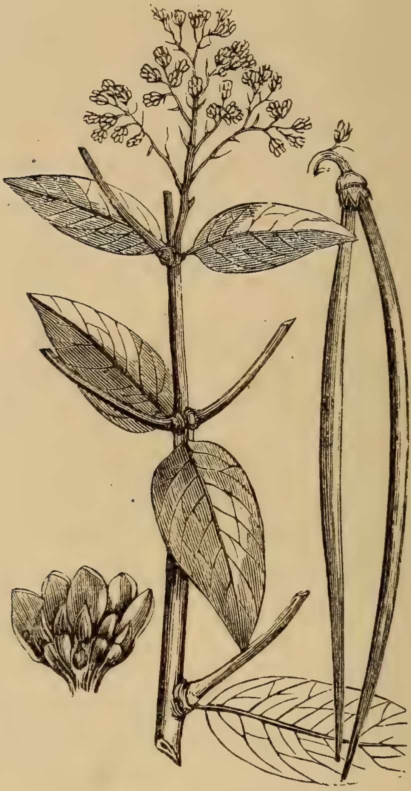
* "Pharm. Rundschau," Sept., 1887, p. 201.

† *London Med. Record*, June 15th, 1886, quoted.

‡ *Amer. Jour. Med. Sci.*, 1886, p. 117.

Description.—The root is the official portion; it is of a yellowish-brown color when young, and of a dark-chestnut when old, has no odor, but a nauseous, acrid, bitter taste. The fresh root, when wounded, pours out a milky juice, whence the plant is sometimes termed *milk-weed*.

Fig. 47.



APOCYNUM CANNABINUM.

Chemical Contituents.—Although the entire root is official, the *bark of the root* is probably alone active. A. androsæmifolium, or Dogsbane, is possessed of much the same properties as A. cannabinum. It yields its virtues to water and alcohol, and contains *gallic* and *tannic acids*, *gum*, *resin*, *apocynin*, *apocynein*, *bitter-extractive*, etc.

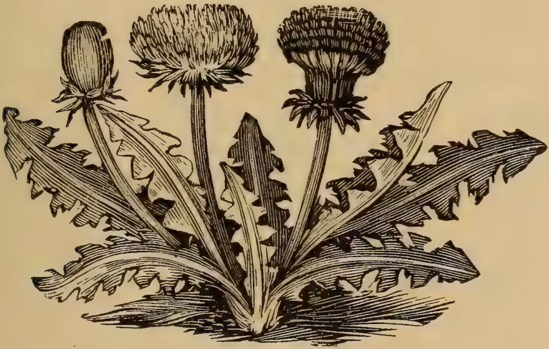
Effects and Uses.—Canadian Hemp is *diuretic*, *diaphoretic*, *sedative*, and, in continued doses, *emeto-cathartic*. It has been shown * to possess a decided cardiac sedative action, analogous to that of digitalis; but without its corresponding elevation of blood-pressure. It is chiefly employed in the treatment of *dropsy*, in which its action is often powerfully efficacious. It should be given in amounts just sufficient to produce diuresis, when a cathartic effect is not desirable.

ADMINISTRATION.—The best form of exhibition is an infusion (℥ss to boiling water Oj, or the same amount may be dissolved in gin Oj); dose, f℥ij-iv three or four times a day.

TARAXACUM.

Taraxacum Dens-leonis, or Dandelion (*Nat. Ord.* Compositæ), is a small herbaceous, perennial plant, common to most parts of the world, and found abundantly throughout the United States.

FIG. 48.



TARAXACUM DENS-LEONIS.

DESCRIPTION.—It has a fusiform root, which sends up numerous long, sinuated, bright-green leaves, and flower-stems about six inches high, bearing golden-yellow flowers. The ROOT is the official portion, and *should be gathered in the autumn.* In the fresh state it is several inches long, branched, fleshy, of a light-brown color externally, whitish within, and abounds in a milky juice; the *fresh* root is preferable for use. When dried it is shrunken, wrinkled and brittle. It is without smell, but has a bitter taste.

CHEMICAL CONSTITUENTS.—Boiling water extracts its virtues, which probably depend on a peculiar bitter crystallizable principle termed *taraxacin*, soluble in water and alcohol. It also contains *taraxacerin*, *resin*, and Dragendorff[*] found *inulin* and some sugar.

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* *Therapeutic Gazette,* Sept. 15, 1889. Geo. R. Murray.

Effects and Uses.—Taraxacum is *diuretic* and slightly aperient, with some tonic action, and a slight determination to the liver. It is useful in *hepatic dropsies*, and is also employed in *dyspepsia* accompanied by derangement of the liver.

Administration.—It may be given in the form of infusion—dose, f℥ij t. d.; *extract* (an inspissated juice, which should not be kept above a year)—dose, gr. xx-ʒj t. d.; *fluid extract*—dose, fʒj-ij t. d.

TRITICUM—COUCHGRASS.

The RHIZOME of Triticum repens or Couchgrass (*Nat. Ord.* Graminaceæ), a perennial weed, native of Europe and North America, growing in fields and in waste places, with a long, stiff, pale-yellow rhizome, which should be gathered in the spring, and is found in the shops, freed from the rootlets, cut into short lengths and dried, without odor, but having a slightly sweetish taste (Flückiger and Hanbury), contains *triticin* (which resembles inulin), and several *sugars*.

Effects and Uses.—Couchgrass appears to be a feeble *diuretic*. According to Sir H. Thompson,[†] it exercises a beneficial influence in *chronic cystitis*. He directs the decoction to be made by boiling ℥ij-iv in water Oij until reduced to Oj; the strained liquor to be taken in four doses in 24 hours. Whitla, too, advises it to allay *irritation of the urinary passages*. The *fluid extract* may be given in doses of fʒss-j.

JUNIPERUS—JUNIPER.

The FRUIT or berries of Juniperus communis (*Nat. Ord.* Coniferæ), an evergreen European shrub, naturalized in the United States, are used as adjuvants to the more active diuretics, and in large doses produce strangury and bloody urine, and prove emmenagogue. When dried they are about the size of a pea, of a blackish-purple color, and a sweetish, terebinthinate, aromatic taste; they are given in infusion. Their virtues depend on a *volatile oil* (OLEUM JUNIPERI) ($C_{10}H_{16}$), the dose of which is gtt. v-xv two or three times a day.

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[*] "Pharmacographia," 2d ed., p. 394, quoted.

[†] "Diseases of the Urinary Organs," 7th edition, p. 152.

Effects and Uses.—Hammond * found that juniper increased the flow of urine, the proportion of solids being only slightly altered (three experiments). Juniper is *employed* as a diuretic in the *dropsy* of cardiac, hepatic and chronic renal maladies. Being a stimulant-diuretic, it is not adapted to acute affections of the kidneys.

Administration.—The *compound spirit* (containing also the oils of caraway and fennel, dissolved in alcohol and water) is a pleasant addition to stimulating diuretic and blennorrhetic combinations, and a good stomachic and carminative; dose, fʒj-ij. The *spirit* is made by dissolving 3 parts of the *oil* in 97 parts of alcohol; dose, fʒj-ij. An active diuretic mixture is: ℞ Potassii bitartratis, ℥ij; seminis juniperi, ℥j; aquæ (tepid), Oiv. M. Sig.—All to be taken in 24 hours.

SCOPARIUS.

Sarothamnus Scoparius, or Broom (*Nat. Ord.* Leguminosæ), is a common European shrub, cultivated in the United States, from three to five feet high, with numerous bright-yellow flowers. The tops of the branches are the official portion, but the *seeds* are also used. The twigs are pentangular (with small oblong, downy leaves), of a bright-green color, a strong, peculiar odor when bruised, and a bitter to nauseous taste.

Chemical Constituents.—Two principles are found in broom-tops—*scoparin* ($C_{21}H_{22}O_{10}$), a neutral, crystallizable body, supposed to be the diuretic constituent, and a volatile poisonous alkaloid, *sparteine* ($C_{15}H_{26}N_2$), (vide p. 284); it also contains *volatile oil*, *tannin*, etc.

Effects and Uses.—Broom is an efficient *diuretic*, in large doses producing free purging. It is a valuable and reliable remedy in *dropsy*, *chronic Bright's disease* and *uremia*, best given in decoction, half an ounce to a pint of water, boiled down to half a pint, of which an ounce may be given every hour or two till the bowels are disturbed. A fluid extract is used in doses of fʒss–j.

CANTHARIS—CANTHARIDES.

The properties, etc., of *cantharides* will be noted fully under the head of *Irritants* (subdivision *Epispastics*). Taken *internally*, they sometimes prove diuretic, and generally excite irritation of the genito-urinary passages, which is shown by strangury, priapism, etc.; and in over-doses act as an acro-narcotic poison. They are employed in dropsies, incontinence of urine, amenorrhœa, seminal weakness, impotence, etc. Dose, gr. j–ij twice a day, in pill. They are most commonly administered in *tincture* (5 per cent.); dose, gtt. x or more three or four times a day till signs of strangury supervene.

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* *Amer. Journ. Med. Sci.*, 1859, p. 275.

ORDER V.—BLENNORRHETICS.

Blennorrhetics (from *βλέννα*, *mucus*, and *ῥέω*, *I flow*) are medicines which promote the secretion of the mucous membranes. They are employed therapeutically in morbid conditions of those membranes, with a view to the restoration of healthy action in cases of deficient, abnormal or excessive secretion.

When administered with the object of stimulating the secretion of mucus from the bronchial or laryngeal membrane, this class of agents is termed *expectorants*. They are prescribed in the subacute and chronic forms of bronchitis and laryngitis, and in the declining stages of the acute forms of those affections and of pneumonia. In the early or inflammatory stages of acute bronchitis and laryngitis the stimulating expectorants are inadmissible until expectoration has been established.

The blennorrhetics are less employed in gastro-enteric affections than in those of other mucous membranes, owing to their tendency to produce catharsis. Several of the oleo-resins are, however, used with advantage in certain forms of chronic diarrhœa, and the oil of turpentine is highly esteemed in the treatment of the diarrhœa of typhoid fever.

The oleo-resinous articles of this group are extensively employed in diseases of the urino-genital mucous membranes—gonorrhœa, gleet, leucorrhœa, incontinence of urine and cystitis.

The following are the articles chiefly resorted to for their influence on the mucous membranes:—

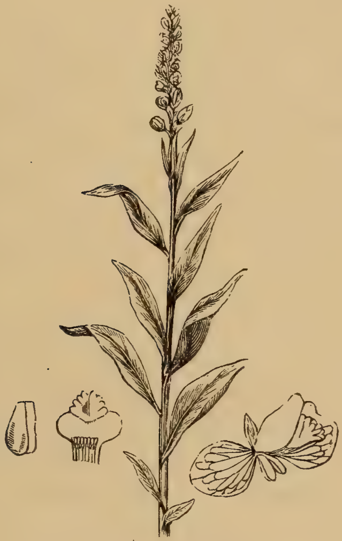
SENEGA.

Polygala Senega, or Senega Snakeroot (*Nat. Ord.* Polygalaceæ), is a small indigenous plant, found in all parts of the United States, but most abundantly in the South and West. It has a perennial branching root, several erect annual stems about a foot in height, alternate lanceolate leaves, and small whitish flowers arranged in a terminal spike.

DESCRIPTION.—The ROOT is the official portion. It occurs in the shops in twisted pieces, varying in thickness from the size of a pill to that of the little finger, attached to a knotty head, and marked with a ridge along their whole length and numerous annular protuberances. The cortical portion is hard, resinous, of a yellowish-brown color, and *contains the active qualities of the root.* The central ligneous portion is white and inert. The odor of senega is peculiar and disagreeable, but faint in the dried root; the taste is at first mucilaginous and sweetish, but afterward becomes acrid and very irritating.

CHEMICAL CONSTITUENTS.—The virtues of senega are extracted by cold and hot water and alcohol. It contains *polygalic acid* (*senegin*), on which its activity chiefly depends; this is identical with *saponin*, a glucoside found in soapwort and other plants (Huseman*).

FIG. 49.



POLYGALA SENEGA.

EFFECTS AND USES.—Senega, in small doses, is an active excitant of the mucous membranes and secretions generally, and in large doses proves *emetic* and *cathartic.*

It is prescribed chiefly as a stimulating expectorant in *chronic* and *subacute bronchial affections*, and in the latter stages of *acute bronchitis* and *pneumonia.* As an ingredient in the *compound syrup*

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* "Die Pflanzenstoffe," 1871, p. 750.

of squill it is much employed in the treatment of *croup*, but, except in some such combination with tartar emetic or other nauseant emetic, it is scarcely admissible in the early stages of this disease. Senega is thought also to possess emmenagogue properties, and it is highly extolled by many practitioners in the treatment of *amenorrhœa.* It has been occasionally used as a diuretic in *dropsies*, and in emeto-cathartic doses has been found useful in *acute rheumatism.*

ADMINISTRATION.—Dose, in powder, gr. x–xx; but the *abstract* is to be preferred; dose, gr. v–xx. The *fluid extract* is given in the dose of ♏x-xx; and *syrup* is also used, in the dose of f℥j-ij.

QUILLAIA.

Quillaia, or Soap-bark, is the BARK of the Quillaia Saponaria (*Nat. Ord.* Rosaceæ), a tree of South America.

DESCRIPTION.—The bark is found in the shops in large flat pieces, brownish-white, with small patches of brownish cork on the outer surface, but otherwise smooth; without smell, but having a very acrid taste; the powder is sternutatory (Maisch).

CHEMICAL CONSTITUENTS.—It contains *saponin* ($C_{13}H_{30}O_{10}$, a glucoside), which in watery infusion foams like soap, and is identical with polygalic acid (senegin).

PHYSIOLOGICAL EFFECTS.—The following statement concerning saponin is based on the investigations of Lhomme* and Kobert.† According to the latter observer, saponin consists of at least four organic substances, viz., of pure *saponin* ($C_{13}H_{30}O_{10}$, inert), *lactosin* (inert), *quillaiic acid* ($C_{19}H_{30}O_{10}$) and *sapotoxin*—the last two powerfully poisonous. The principle experimentally used by Lhomme seems to have been a mixture of these substances. *Locally*, it is a protoplasmic poison, and applied to the skin with friction is irritant, and if it be continued, will cause suppuration. It abolishes instantly the excitability of the striated muscles and nerves when in contact with them. Applied directly to the heart it rapidly stops it in diastole, and antagonizes the effect of digitalis upon it. Kobert ascertained, his experiments being made with quillaiic acid, that when injected into the veins of dogs, and also by the stomach, it expended much of its force upon the alimentary canal, which was found to be in a highly inflamed condition. Both he and Lhomme found that when introduced into the veins in sufficient quantity it paralyzed voluntary motion, abolished the reflex excitability of the cord, lowered the blood-pressure, and gradually stopped the heart's beats. By ingestion it is much less toxic. Brought in contact with the nose and throat it produces violent sneezing and coughing ; applied to the conjunctiva it causes pain, swelling and a flow of tears. Lhomme observed, without making exact experiments, that the urinary and dermal secretions were considerably diminished in frogs, rabbits and rats. Schroff noticed an increase of the bronchial mucus.

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* Pamphlet, "Étude exper. sur l'action physiol. de la saponine."

† *Arch. f. exper. Pathol. u. Pharmak.*, 1887; also *Am. J. Pharm.*, March, 1889, quoted.

Medicinal Uses.—Quillaia is rarely employed *medicinally*, nor are its exact therapeutical uses yet placed on a scientific basis. As an expectorant in *chronic bronchitis*, *emphysema* and *dilatation of the bronchi*, it has been highly recommended (Kobert*) It is contraindicated where a disposition to hemoptysis is present (A. Maslovski †), and in inflammatory conditions of the alimentary tract. It is chiefly useful from the property it possesses of emulsifying oils.

Administration.—Dose, gr. xv-xxx in infusion t. d. A fluid extract mixed with glycerin forms an admirable local application to some cases of *acne* (Piffard).

ALLIUM—GARLIC.

Allium sativum (*Nat. Ord.* Liliaceæ) is a small perennial, bulbous plant, which grows wild in the south of Europe, and is cultivated in all parts of the world.

Description.—The bulb is the portion used. As found in the shops, it is somewhat spherical in form, about an inch in diameter, with the portion of the stem attached, covered with a white, membranous envelope, and consists of five or six smaller bulbs, of a curved, oblong shape, called *cloves* of garlic. They have a strong, irritating, characteristic odor and a bitter, acrid taste.

Chemical Constituents.—Water, alcohol and vinegar extract their virtues, which depend on an *essential oil*, which is of a yellow color, very volatile and irritating; it consists of allyl (C_3H_5) oxide and sulphide.

Effects and Uses.—Garlic is a *local* irritant and rubefacient; taken *internally*, it quickens the circulation and stimulates the secretions generally. It is a good deal *employed* as an expectorant in *chronic* and *acute bronchitis*, particularly in infantile cases, and occasionally as a stomachic in *flatulence*, and as a diuretic in *dropsies*. *Externally* it is used as a rubefacient.

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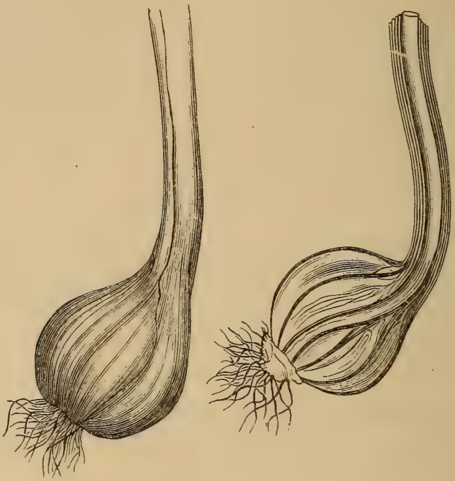
* *Central f. Klin. Med.*, No 30, 1885.

† *Russ. Meditz.*, No. 36, 1886, p. 599.

FIG. 50.



GARLIC—BULBS.

Administration.—A clove may be swallowed entire, or cut into small pieces. Dose of the fresh bulbs, ʒj-ij, in pill; of the juice, fʒss, mixed with sugar; of the *syrup*, fʒj, for children.

SCILLA—SQUILL.

Squill, already noticed among Diuretics, is one of the most powerful and valuable stimulating expectorants in the Materia Medica. (For properties, doses, preparations, etc., see index for scilla.)

TEREBINTHINA—TURPENTINE.

The term *turpentine* is applied to liquid or concrete vegetable juices, consisting of *resin* combined with a peculiar essential oil, called *oil of turpentine*.

Varieties.—Two kinds of turpentine are recognized by the U. S. Pharmacopœia: 1. The *common American white turpentine*, which is procured chiefly from Pinus australis (*Nat. Ord.* Coniferæ), a large indigenous evergreen tree of our Southern States, where it is called *Long-leaved Pine*, *Yellow Pine*, and *Pitch Pine;* and in part also from Pinus tæda, found in Virginia, and other species of Pinus. 2. *Canada turpentine* (*Terebinthina canadensis*), kept in the shops under the name of *Canada balsam* or *balsam of fir*, the product of Abies balsamea, the American Silver Fir or Balm of Gilead Tree, (*Nat. Ord.* Coniferæ), a handsome tree about forty feet in height, inhabiting the northern portions of North America. Many other varieties of turpentine are known in commerce, as *Bordeaux turpentine*, *Venice turpentine*, *Chian turpentine*, etc.

PREPARATION.—*White turpentine* comes from North Carolina and other Southern States, and is collected from excavations (called technically "boxes"*) made in the trunks of the trees, from March to November, into which the turpentine runs in the mild weather. It is yellowish-white and somewhat translucent, semi-fluid in summer, firm and hard in winter, but becoming permanently hard by exposure to the air, and has a peculiar aromatic odor and a warm, pungent, bitterish taste. *Canada turpentine* comes from Canada and Maine. It is procured by breaking the vesicles which are found between the bark and wood of the trees and collecting the liquid contents in a bottle. When fresh it has the consistence of honey, but gradually solidifies by age. It is yellow, transparent, tenacious, of a peculiar pleasant, terebinthinate odor and a slightly bitter, acrid taste.

CHEMICAL CONSTITUENTS.—The turpentines yield, by distillation, a *volatile oil* known as *oil of turpentine*, and leave a residue consisting exclusively of *resin*. Both the *oil* and *resin* are official. The turpentines are inflammable, nearly insoluble in water, but almost wholly soluble in alcohol and ether.

PHYSIOLOGICAL EFFECTS.—The *local* operation of the terebinthinates is irritant. When applied to the skin they produce a rubefacient effect, and when swallowed *in large doses*, promote the peristaltic motion of the intestines. Taken *internally*, in small doses, they are absorbed, and prove excitant to the vascular system and the secretions generally, especially the mucous membranes; they communicate an odor of violets to the urine. In large doses they cause pain in the loins, strangury and bloody urine. The activity of the terebinthinates depends on their *volatile oil*.

MEDICINAL USES.—Turpentine is employed chiefly in diseases of the various mucous membranes, as *gonorrhœa*, *gleet*, *leucorrhœa*,

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*"Our Slave States," 1856, p. 339, F. L. Olmsted.

chronic bronchitis, and *chronic mucous diarrhœa.* It is also used in *iritis*; and, in cathartic doses, in cases of *thread*-and *tape-worms.*

ADMINISTRATION.—Dose, as a *blennorrhetic*, gr. xx–ʒj, in *pill*, *emulsion*, or *electuary*; as an *anthelmintic* or *cathartic*, ℥ss–j in emulsion. The *white turpentine* is generally used in this country.

Chian Turpentine is derived from Pistacia Terebinthus (*Nat. Ord.* Anacardiaceæ), and is collected chiefly in the island of Scio, during the summer months, the juice flowing spontaneously from incisions made in the bark. It is "greenish-yellow or brownish, hardens to a transparent mass, and has a fennel-like terebinthinate odor, and a mild, bitterish taste" (Maisch). It is very expensive, and but little of it comes to this country. It has been extolled in the treatment of *uterine cancer*, but sound observers* now agree that it is utterly valueless as a curative agent. Dose, gr. v, increased to gr. xxv, in emulsion.

Oleum Terebinthinæ (*Oil of Turpentine*) ($C_{10}H_{16}$) commonly called *spirit of turpentine*, is the active principle of turpentine, obtained by distillation. It is a limpid, colorless, volatile and inflammable liquid, of a strong, penetrating, peculiar odor and a hot, pungent, bitterish taste; very slightly soluble in water, less soluble in alcohol than the volatile oils generally, and wholly soluble in ether; exposed to the air it absorbs oxygen, with the formation of resin. Its effects and medicinal uses are the same as those of turpentine, for which it is usually substituted in practice.

AIDS.—Its effects are enhanced by the alcoholic and diffusible stimuli.

CONTRAINDICATIONS.—In cardiac hypertrophy, atheroma of the vessels, and acute renal inflammation.

PHYSIOLOGICAL EFFECTS.—*Locally*, it acts as a rubefacient. When *swallowed* in large doses, as f℥j–ij, it commonly passes off by the bowels; taken in small doses, it is absorbed and, according to the investigations of Hare,† it increases the number of the cardiac beats, due to a direct action on the heart; large doses decidedly slow the pulse by stimulation of the vagus inhibitory centre. Its influence, either in large or small amounts, is indifferent upon the vaso-motor centre, though this statement, is not in accord with that of Kobert.‡ Small doses increase reflex action, while large de-

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[*] *Lancet*, Dec. 4th, 1880. Mr. Henry Morris. [†] *Med. News*, Phila., 1887, II, p. 593.

[‡] *Arch. für Anat. u. Physiol.*, 1886—quoted.

crease it; the first being due to stimulation, and the latter to depression of the cord and afferent nerves. Toxic amounts destroy life by causing cardiac failure. Respiration is at first increased, but afterward diminished as to frequency. Secretion: when given in moderate doses it stimulates the kidneys, augmenting the urinary flow. In large amounts (f℥j–ij), the urine is diminished, often bloody and sometimes suppressed. Toxic quantities provoke constant efforts at micturition, strangury and often priapism. Gastro-intestinal tract: in large quantities it causes vomiting and purging, with abdominal pain and a sense of heat. Elimination: by the broncho-pulmonary mucous membrane and kidneys (chiefly).

Toxicology and Antidotes.—The *lethal dose* is not determined, but poisonous effects from the oil of turpentine are rare, as it generally passes off by the bowels; it may, however, produce severe vomiting and purging, bloody or suppressed urine, intense irritation of the urino-genital organs, unconsciousness, with dilated pupils, and even death. An infant* swallowed f℥½, but recovered after convulsions. Its toxic effects may be antagonized by emptying the stomach and the administration of anodynes and demulcents. Physiologically it is antagonized by the cardiac depressants.

Medicinal Uses.—In *large doses* it is employed as an anthelmintic and cathartic, and is much used as a clyster for the relief of *tympanites*. In *small doses* it is much prescribed in chronic discharges and hemorrhages from the various mucous membranes; in the latter stages of *typhoid fever*, where the abdomen is tympanitic and the tongue dry; as a combined stimulant and blennorrhetic; as a stimulant in *typhus fever*† and *purpura*; as a diaphoretic in *rheumatism*, and in nephritic disorders as *pyelonephritis*. As a *rubefacient*, it is a valuable counter-irritant in numerous diseases, as to the joints in *chronic rheumatism*, and should usually be applied with gentle friction. Turpentine-stupes are highly efficacious in *bronchial catarrhal affections*.

Administration.—Dose, gtt. v–xxx, repeated, as a *blennorrhetic stimulant*; f℥ss–j, as a *cathartic enema* or *anthelmintic* against *round* and *thread-worms*,‡ in emulsion or capsule. *Linimentum terebinthinæ* (oil of turpentine, 35 parts, melted with resin-cerate,

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* *London Med. Times*, 1851, p. 380.

† *Am. Journ. Med. Sci.*, 1866, p. 48. DaCosta.

‡ *Journal de Thérap.*, 1876, p. 871.

65 parts), is used as a stimulative application in various affections, as, *chilblain*, *lumbago* and *myalgia.*

Pix Liquida (*Tar*) is an impure turpentine, procured, by burning, from the wood of Pinus palustris and other species of Pinus. It is a brownish-black, viscid, semi-liquid substance, of a peculiar empyreumatic odor and a bitterish, resinous, somewhat acid taste; soluble in alcohol, ether and the volatile and fixed oils. It consists of resin united with acetic acid, oil of turpentine and various volatile empyreumatic products. By distillation it yields *pyroligneous acid* and *oil of tar*, the residuum being pitch.

The *oil of tar* (*oleum picis liquidæ*) contains, besides oil of turpentine, *creasote* (see Antiseptics) and other principles. Its effects are similar to those of tar, and it is much used in the form of ointment in the treatment of squamous skin diseases.

Toxicology.—A case is reported, of non-fatal poisoning,* by oil of tar of a man who, having swallowed about one gill, was seized after seven hours with vomiting, excessive abdominal and inguinal pain and exhaustion, the urine being high-colored and having the odor of the drug.

Effects and Uses.—Tar resembles the turpentines in its effects, and is employed in *chronic catarrhal affections* and other diseases of the mucous membranes. Its vapor has been inhaled in *bronchitis, acute* and *chronic;* and *externally* it is an excellent application in *tinea capitis*, *psoriasis* and *eczema.* The therapeutical application of the tarry preparations in diseases of the skin has been well described by Bulkley† as follows: they are contra-indicated in cases of decided pain, heat or swelling, and indicated where it is desirable to improve the nutrition, check the itching, secretion and cell-deposit of a part. Their disadvantages are odor, color and stickiness: the former can be partly disguised by oil of lavender. Equal parts of pix liquida and unguentum sulphuris is an excellent application to *scaly eczema* and *palmar psoriasis,* and it should be applied with friction. In liquid form the following has been used with advantage to allay the intense itching of eczema after the exudation has ceased, and also in *lichen.* ℞ Picis liquidæ, f℥ij; potassæ causticæ ʒj; aquæ f℥v. M. Solve (may require dilution); in chronic cases it should be rubbed in of full strength. The infusum picis liquidæ (tar Oj aq. Oiv) is another serviceable liquid preparation in *eczema* and *prickly heat*, being curative as well as antipruritic. In parasitic diseases as *ringworm* and *favus*, the following unirritating combination is useful: ℞ Iodinii, ʒij; olei picis liquidæ, f℥j. M. Solve. Mix carefully and rub in freely.

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* *Lancet,* 1832-3, p. 598.

† *Arch. of Scientific and Practical Medicine,* 1873, pp. 123 172.

ADMINISTRATION.—Dose, ʒss–j several times a day, in pill or electuary. The *syrup* contains six per cent. of tar, and is a good preparation. The *ointment* (*unguentum picis liquidæ*) is made by mixing equal parts of tar and melted suet.

Resina (*Resin*), commonly called *rosin*, is the residue after the distillation of the oil from turpentine. It is a yellowish-brown, semi-transparent, solid, brittle substance, with a slight terebinthinate odor and taste — insoluble in water, soluble in ether, alcohol and the essential oils, readily uniting by fusion with wax and the fixed oils, and forming soluble soaps with the alkalies. When agitated with water, in a state of fusion it becomes opaque and *white*. It is not used *internally*, but is extensively employed in the formation of *plasters* and *ointments*, to which it communicates great adhesiveness and slightly stimulant properties.

Ceratum resinæ (*resin-cerate*), formerly called *basilicon ointment*, is made by melting resin (35 parts), lard (50 parts) and yellow wax (15 parts) together; it is an excellent mild stimulant application to *burns, blistered surfaces*, etc. Compound resin-cerate may be made by melting ℥xij of resin, suet and yellow wax, each, with ℥vj of turpentine and f℥vij of flaxseed oil—a good stimulant cerate, very popular under the name of *Deshler's Salve*—a favorite application to *fissure of the nipples*. *Emplastrum resinæ* (*resin-plaster*), made by melting 14 parts of resin with 80 parts of lead-plaster and 6 parts of yellow wax, is the well-known *adhesive plaster*, which is used to retain the edges of *wounds* in contact, to produce extension in the treatment of *fractures*, to protect *abraded surfaces*, and to promote absorption as in *hydrocele* and *orchitis*. It must be heated before application.

An *adhesive rubber plaster* is now made that offers the advantage of sticking where applied without the aid of heat or other agent.

COPAIBA.

Copaiba is an OLEO-RESIN obtained from several species of Copaifera (*Nat. Ord.* Leguminosæ), large trees peculiar to South America. C. Langsdorffii, a native of Brazil, is now recognized as the principal source of copaiba, and most of the copaiba of commerce is derived* from the ports of Para and Maranham, in Brazil; Central America also yields copaiba.

PREPARATION.—The juice is obtained from incisions in the stems of the trees; as it at first exudes it is clear, colorless and very thin, but soon acquires a thicker consistence and a yellowish hue. As found in the shops it is a clear, transparent liquid, of the consistence of olive-oil, of a pale-yellow color, a peculiar agreeable smell and a pungent, nauseous, acrid taste. By exposure to the air it acquires a deeper color and denser consistency. It is often adulterated.

CHEMICAL CONSTITUENTS.—Copaiba is insoluble in water, but soluble in alcohol, ether, and the volatile and fixed oils; with alkalies and alkaline earths it forms a soap. It is chemically an *oleo-resin* (40 to 60 per cent. of volatile oil, but the proportion of oil to resin varies considerably†), with a minute portion of acetic acid. The VOLATILE OIL is official, as is also the RESIN, which possesses acid properties, and is sometimes called *copaivic acid.* By exposure to the air copaiba gradually becomes darker and thicker, and finally hard and brittle, owing to the volatilization and oxidation of its oil. A pulverizable residue should remain when the volatile oil is driven off by heat. Copaiba was formerly called a *balsam,* but this title is incorrect, as it contains no *benzoic* or *cinnamic acid.*

CONTRAINDICATIONS.—Gastro-intestinal irritation and renal inflammation.

PHYSIOLOGICAL EFFECTS.—The effects of copaiba are *analogous* to those of the terebinthinates. In large doses it proves *cathartic* and occasionally emetic, and in small doses it is absorbed, communicating its peculiar odor to the secretions and exhalations, and stimulating the secretions from the mucous membranes and kidneys; it is also a gentle excitant to the circulatory system. The urine of persons who have taken copaiba for some time yields a precipitate with nitric acid, like albuminous urine, due to the action of the acid on the resin. The resinous precipitate, however, is soluble in alcohol, which does not dissolve coagulated albumen. Elimination takes place slowly. Occasionally copaiba causes symptoms of strangury when given in large doses. It sometimes produces an eruption of the skin, and some persons are unable to take it in any dose, on account of the gastro-intestinal irritation which it occasions. When its administration is too long continued, or when excessive doses are given, it may undoubtedly cause serious damage to the structure of the kidney.

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* "Pharmacograph," 2d ed., p. 232.

† *Am Journ. of Syphilography,* III, p. 293.

Medicinal Uses.—Copaiba is employed in diseases of the mucous membranes, particularly those of a chronic character, as *chronic bronchitis*, *gonorrhœa*, *gleet*, and *irritation of the bladder*, and, like turpentine, occasionally in *iritis*.

As a remedy in *gonorrhœa* it has long enjoyed great popularity, and is given in some cases with advantage even in the early stages. Though often of signal service in the treatment of gonorrhœa, it frequently fails to ameliorate the disease, for, in 15 cases in which copaiba was the basis of treatment together with injections, recorded by Milton,* the average duration of each was 88 days—not brilliant evidence of the utility of the remedy. The good results obtainable with this drug are often missed through inattention to concomitant matters. During the acute stage the inflammatory symptoms, if severe, must be combated by rest, and the local application of lead or ice-water; the parts should be kept clean; the urine neutralized; a non-stimulant diet enforced by abstention from meats and alcoholics; erections suppressed by avoiding lascivious thoughts; and chordee restrained with a large dose of potassium bromide (ʒ½–j), at 9–10 P. M., combined with a motor-depressant, as tincture of gelsemium (gtt. x), both to be repeated at 3–4 A. M., the time when chordee is most likely to set in. When the acute symptoms have begun to subside under this plan of treatment the time for the exhibition of copaiba and urethral medication has arrived. Urethral injections of copaiba have been tried, but have not yielded good results; it therefore appears to be necessary, in order to obtain its curative effects, that the drug should be modified in the system before its passage over the urethral tract. In gonorrhœal vulvitis and vaginitis it is comparatively useless. Copaiba is sometimes advantageously combined or alternated with cubeb. When it nauseates, it should be suspended, or the dose reduced. It is best administered on an empty stomach. It is often advantageously combined with solution of potassa, which diminishes the acidity of, and hence the irritation produced by, the urine.

Administration.—Dose, gtt. xx to fʒj t. d., in *emulsion*, with some aromatic water,* or in pilular mass (*massa copaibæ*), made by mixing copaiba 94 parts with magnesia 6 parts, or in *capsules* of gelatin, which is the preferable mode of administration. These can be obtained in the shops, each containing ♏v or x. It is also administered as a clyster, in emulsion.

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* "Gonorrhœa," etc., 1877, p. 75.

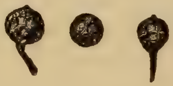
Oleum Copaibæ (*Oil of Copaiba*) ($C_{15}H_{24}$), obtained by distillation from copaiba, is usually colorless, with the odor and taste of copaiba, and produces the same effects on the system. (U. S. Dispensatory, 15th Ed.) Dose, gtt. x–xv, in *emulsion* or dropped on sugar.

CUBEBA—CUBEB.

Cubeb is the UNRIPE FRUIT of Cubeba officinalis (*Nat. Ord.* Piperaceæ), a climbing perennial plant of Java and other parts of the East Indies.

DESCRIPTION.—The berries are gathered for use when unripe, and are dried. They are about the size of a small pea, of a blackish or grayish-brown color, a reticulated surface, and furnished with a stalk two or three lines long. The shell is hard, and contains a blackish seed, which is white and oily within. The odor of cubeb is aromatic; the taste warm, acrid, and camphoraceous. The berries deteriorate by age, most rapidly in powder, owing to the escape of their volatile oil.

FIG. 51.



CUBEB–BERRIES.

CHEMICAL CONSTITUENTS.—Their most interesting constituents are a VOLATILE OIL (which is official) ($C_{30}H_{48}$), a principle called *cubebin*, and *resinous* matter; the resinous matter consists of both a hard and a soft resin, the former insoluble in ether, the latter soluble in ether, of acid reaction, and termed *cubebic acid.* The *oil* is carminative and stimulant, and the blennorrhetic and diuretic properties of cubeb reside chiefly in the *resin;* cubebin is inert.

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* *Chapman's Copaiba Mixture,* is, copaiba and spirit of nitrous ether, each half a fluidounce; powdered gum-arabic and sugar, each a drachm; compound spirit of lavender, 2 fluidrachms; tincture of opium, a fluidrachm; distilled water, 4 fluidounces; dose, a tablespoonful three times a day. Often very efficient in the treatment of *gonorrhœa.*

Effects and Uses.—In large doses cubeb, like the other oleoresins, excites more or less gastro-enteric disturbance. In small doses it produces a stomachic effect like that of black pepper; after its absorption it acts as a gentle excitant to the vascular system, with a very decided stimulant action on the mucous surfaces, particularly those of the urino-genital apparatus; it also frequently proves diuretic. It is eliminated chiefly by the urine, increasing the excretion of uric acid, and under its use the urine yields a precipitate with nitric acid. An eruption, like urticaria, sometimes follows the administration of both copaiba and cubeb.

It is used chiefly in the treatment of *gonorrhœa*, and should be given under the same conditions as copaiba (q. v.). The late Prof. Joseph Pancoast prescribed it as follows: ℞ Pulveris aluminis, ʒj; pulveris cubebæ, ℥iv; pulveris cinnamomi, ℥ss. M. et Sig.—Tablespoon in half a glass of water three times a day. When thus given, it quickly allays the scalding pain which accompanies urination.

Powdered cubeb-berries have been used as a smoke in *nasal catarrh;* they also enter into the composition of voice-lozenges that are useful in *chronic pharyngitis.*

Administration.—Dose of the powder, ʒj–iij t. d., in gonorrhœa; in chronic mucous disorders smaller doses are given. The oil is often employed, *but it does not possess* the *full virtues* of cubeb—dose, gtt. x–xij, to be repeated and gradually increased; it may be taken in emulsion, or dropped on sugar, or made into gelatinous capsules with oil of copaiba. The *oleo-resin* contains both the volatile oil and resin, with a portion of cubebin, and is an excellent preparation—dose, ♏v–xxx, suspended in water; of the *tincture*, the dose is fʒj–ij t. d.; of the *fluid extract*, the dose is fʒss–j. *Troches of cubeb* are made with the oleo-resin, oil of sassafras, extract of glycyrrhiza, and acacia, mixed with syrup of tolu. Each troche contains gr. ½ of oleo-resin.

OLEUM SANTALI—OIL OF SANTAL.

The oil of Santal or of Sandal Wood is a volatile oil distilled from the wood of Santalum album (*Nat. Ord.* Santalaceæ), a small tree found in tropical Asia.

The oil is pale yellowish and thick, readily soluble in alcohol when fresh, having an aromatic odor resembling the smell of the wood, and a pungent, spicy taste.

Effects and Uses.—It has been highly recommended in the treatment of *gonorrhœa*, though the experience as to its efficacy in this disease is contradictory. It was introduced by Henderson* who states that he always obtained with it marked suppression of the discharge, and by whom it is regarded as quite equal to copaiba. Beach† reports his experience in 100 cases as follows: average duration of the uncomplicated cases six weeks, shortest case six days, longest about 42 days. He gave gtt. xx or more t. d. In this disease its effects seem to be similar to those of copaiba, but it is not so apt to disagree with the stomach. In a series of 12 cases of gonorrhœa in which it was administered by the editor in doses of gtt. x, t. d., the results were not uniform. In a few cases it appeared to cut short the disease in about four days; in others it disagreed with the patient and was abandoned, and in some cases no benefit was obtained. Milton‡ records 22 cases without a single cure. It occasionally (in about four per cent. of cases) produces vertigo, when the dose should be lessened or the medicine discontinued. It is very expensive, and is often adulterated with olive-oil.

Administration.—It may be given in doses of ♏v–xx, t. d. on a lump of sugar, in mucilage, in alcohol and cinnamon-water, or it can be obtained in gelatin-capsules, ♏v each, in the shops. An objection to its use is the odor of the drug, which its ingestion soon imparts to the breath. It should be administered at the onset of the disease.

MATICO.

This name is given to the LEAVES of Artanthe elongata (*Nat. Ord.* Piperaceæ), a shrub of Peru. They are from two to six inches long by about an inch in breadth, oval-lanceolate and acuminate in shape, crenate, strongly veined or reticulated, bright-green on the upper surface, paler beneath, of a pleasant, aromatic odor and a strong, spicy, slightly astringent taste. The stalks and spikes of the plant are generally mixed with the leaves, more or less compressed into a lump of a greenish color. Matico contains *resin*, *volatile oil*, *artanthic acid*, *tannin*, etc.

Effects and Uses.—Matico is a pleasant aromatic tonic, with a special determination to the mucous membranes. It is used as an alterative stimulant in the entire circle of diseased mucous membranes, especially those of the urinary passages. It is also occasionally prescribed *internally* as a hemostatic, and *locally* as a styptic.

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* *Glasgow Med. Journ.*, Vol. XIII, p. 70; and *Med. Times and Gaz.*, 1861, p. 571.

† *Boston Med. and Surg. Journ.*, 1868–9, p. 213.

‡ "Gonorrhœa, etc.," 1887, p. 87.

ADMINISTRATION.—Dose, of the powder, ʒss–j; of the *fluid extract*, f ʒss–j; of the *tincture*, f ʒj–ij.

PAREIRA.

Pareira or Pareira Brava is the ROOT of Chondodendron tomentosum (*Nat. Ord.* Menispermaceæ), a native of Brazil. It comes to us, in large, wrinkled, twisted or forked cylindrical pieces, of variable thickness and length, covered with a thin, grayish-brown bark. The interior is ligneous, yellowish, porous, inodorous, and of a sweetish, nauseous, bitter taste. The stem is sometimes found in the shops mixed with the root; it is inert.

CHEMICAL CONSTITUENTS.—It imparts its virtues to water, and contains a bitter alkaloid, termed *cissampeline* ($C_{18}H_{21}NO_3$), (identical with *pelosine*, *buxine*, and *beberine*, Flückiger,*) *resin*, *fecula*, etc.

EFFECTS AND USES.—Pareira is an excellent remedy in chronic diseases of the urinary passages, particularly *chronic cystitis* or *irritation of the bladder*, with morbid secretion. It is thought to be also tonic, aperient, and diuretic.

ADMINISTRATION.—Dose, in substance, ʒss–j. The *fluid extract* is much used—dose, f ʒss.†

BUCHU.

This is the name given to the LEAVES of Barosma betulina and other species of Barosma (*Nat. Ord.* Rutaceæ), shrubby plants, growing at the Cape of Good Hope.

DESCRIPTION.—As found in the shops, buchu leaves are from three-quarters of an inch to an inch and a half long, from three to five lines broad, elliptical, lanceolate-ovate or obovate, sometimes pointed, sometimes blunt, notched, and glandular at the edges, and of a green color, paler on the under surface. Three varieties are known, viz.: *short* or *round* buchu (derived from B. betulina), *medium-sized* (from B. crenulata), and *long* buchu (from B. serratifolia). They have a strong aromatic odor and a bitterish taste, like that of mint.

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* "Pharmacographia," 2d edition, pp. 28 and 109.

† A good prescription in *irritable bladder* is fluid extract of pareira brava, f ℥j; compound spirit of juniper, f ℥ij; benzoic acid, ʒj; sulphate of morphia, gr. j; dose, a teaspoonful three times a day.

CHEMICAL CONSTITUENTS.—Water and alcohol extract their virtues, which depend on a *volotile oil* (which yields barosma camphor*) and *bitter-extractive.*

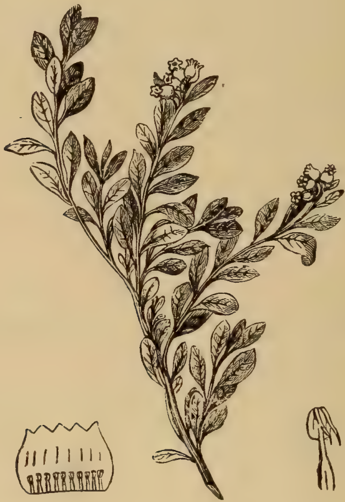
EFFECTS AND USES.—Buchu is a gentle *stimulant* to the *secretions* generally, particularly to the kidneys and urinary mucous membranes; it may be made to act also as a diaphoretic. It is chiefly *employed* in *urethritis* and *chronic cystitis*, *chronic nephritic complaints*, and *incontinence of urine.*

ADMINISTRATION.—Dose, of the powder, gr. xx–xxx; of the *fluid extract*, fʒss–j.

UVA URSI.

Arctostaphylos Uva ursi, or Bearberry (*Nat. Ord.* Ericaceæ), is a small trailing evergreen shrub, with coriaceous, obovate leaves (somewhat like the box-leaves and red whortleberry leaves), about half an inch in length, pale rose-colored flowers appearing from June to September, and small red berries which ripen during the winter. It is found in the northern parts of Asia, Europe and America. The LEAVES are the only part used. When dried they have a faint hay-like odor and a bitterish, astringent taste.

FIG. 52.



UVA URSI.

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* "Pharmacographia," 2d edition, pp. 28 and 109.

Chemical Constituents.—They yield their virtues to water and alcohol, and contain *tannic* and *gallic acids*, *ursone*, a crystallizable glucoside termed *arbutin* ($C_{24}H_{32}O_{14}$), a bitter substance termed *ericolin* ($C_{34}H_{56}O_{21}$), *extractive*, *resin*, *gum*, etc.

Effects and Uses.—Uva ursi is *astringent*, *tonic*, and *diuretic* and exercises a beneficent control over discharges from mucous surfaces; hence its employment in *chronic cystitis*, and *chronic bronchitis* with profuse discharge. It is applicable also to the ordinary uses of the vegetable astringents.

Administration.—Dose, of the powder, gr. x–ʒj. The dose of the *fluid extract* is fʒss–j.

CHIMAPHILA.

Chimaphila umbellata, Pipsissewa, Wintergreen, or Ground-Holly (*Nat. Ord.* Ericaceæ), is a small indigenous evergreen plant, common to the northern parts of Europe, Asia and America, and found abundantly in woody situations in all parts of the United States. It has an erect stem three to ten inches high, lanceolate, somewhat wedge-shaped, serrated, dark-green leaves arranged in irregular whorls, and beautiful five-petaled flowers, of a white color tinged with red and a very agreeable perfume, which appear in June. The leaves are the official portion. In the fresh state they have a fragrant smell when bruised, which they lose after drying. Their taste is bitterish and astringent, but somewhat aromatic.

Chimaphila maculata, or Spotted Pipsissewa, possesses properties analogous to those of C. umbellata, from which it differs principally in the character of its leaves. They are of a deep olive-green color, mixed with greenish-white; and the flowers are of a pure white, and appear in July.

Chemical Constituents.—They contain *arbutin* (not ursone), *tannic acid*, *chimaphilin* (crystalline),, an *oil*,* identical with oil of birch, *methyl salicylate*, an *hydro-carbon* ($C_{15}H_{24}$), and small quantities of *benzoic acid*.

Effects and Uses.—Pipsissewa is *tonic*, *astringent*, *diuretic* and *blennorrhetic*, resembling buchu and uva ursi in its effects, but being a more active diuretic, and is used in the disorders of the urinary organs to which they are applicable, and, from its diuretic properties in *dropsy*. According to Abet,† who made a careful analysis of the leaves, the diuretic principle resides in them, which he designates as a "soft alcoholic extract;" and with this he got good results in ten cases of *cardiac dropsy* attended by dyspnœa.

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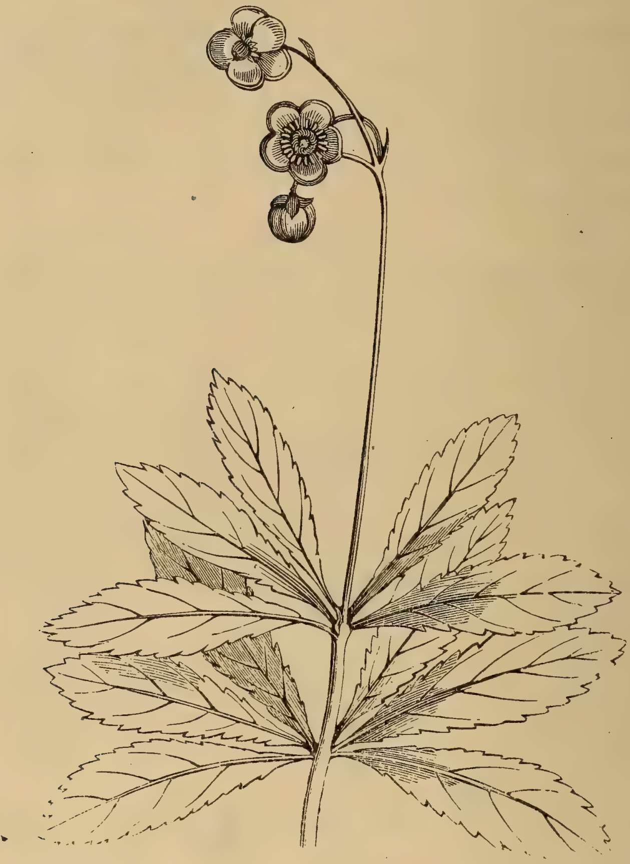
* Am. Journ. of Pharmacy, Aug. 1889. Trimble and Schroettes.

† *Bull. Gén. de Thérap.*, 1889, to ii, p. 64.

FIG. 53.



CHIMAPHILA UMBELLATA.

ADMINISTRATION.—The dose of the *fluid extract* is fʒss–j.

MYRRHA—MYRRH.

Myrrh is a GUM-RESIN obtained from Balsamodendron Myrrha (*Nat. Ord.* Burseraceæ), a small shrubby tree of Arabia Felix and Africa.

PREPARATION AND DESCRIPTION.—Most of the myrrh of commerce is derived from the eastern coast of Africa, in the Somali* district, where it is collected by the Arabs. The juice exudes spontaneously and concretes upon the bark (like cherry-tree gum). It is imported from Bombay, and occurs in small, semi-transparent, reddish-yellow fragments or tears—sometimes agglutinated together in large masses—of irregular shape and size, with an agreeable, peculiar odor and a bitter, aromatic taste. It is brittle and pulverizable, has a resinous fracture, and makes a light-yellowish powder. Inferior kinds of myrrh are darker and less translucent and odorous.

Chemical Constituents.—Myrrh is a *gum resin* (of resin 25–40 per cent.), containing also a little *volatile oil* (¾ per cent.) and a *bitter-principle* (glucoside ?). It forms with water an emulsion, and is soluble in alcohol and ether.

Effects and Uses.—Myrrh is *stimulant*, *expectorant* and *emmenagogue*. It is prescribed in chronic catarrhal and asthmatic affections in which a combined corroborant and expectorant effect is desirable. Chalybeates and aloes are frequently united with it in uterine affections. *Locally*, it is a good application to the spongy gums of *gingivitis* and *aphthous sore mouth*. In *fetid breath* the following forms a good cleansing mouth-wash: ℞ Tincturæ myrrhæ, f℥j; acidi carbolici liquidi, ♏x. M. Sig.—Rinse the mouth with a teaspoonful in ½ tumbler of water.

Administration.—Dose, gr. x–xxx in powder or pill, or suspended in water, as in *mistura ferri composita* (see p. 168). The *tincture* is employed chiefly externally; dose, internally, fʒss–j. *Pills of aloes and myrrh*, *compound galbanum pills* and *compound iron-pills* are official emmenagogue preparations of myrrh.

BENZOINUM—BENZOIN.

Benzoin is a balsamic resin obtained from Styrax Benzoin, or Benjamin tree (*Nat. Ord.* Styraceæ), a tall tree of northern Sumatra,† and Siam.

Preparation.—It is obtained by incisions in the bark from which it readily exudes, afterward hardening by exposure to the sun and air, when it is pared off with a knife. Two kinds are known, the more valuable consisting chiefly of whitish *tears*, united by a reddish-brown connecting medium, and called *benzöe amygdaloides*, the other of brown or blackish *lumps*, without tears, known as *benzöe in sortis* (*benzoin in sorts*). Benzoin has a fragrant odor, a feeble, slightly aromatic taste, is soluble in alcohol and ether, and is precipitated from its alcoholic solution by water.

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* *Pharm. Journal*, XII, p. 226. Jas. Vaugh.

† "History of Sumatra," p. 123, 1783. Marsden.

CHEMICAL CONSTITUENTS.—Its chief constituents are *resin* and BENZOIC ACID ($C_7H_6O_2$), which places it among the BALSAMS; it contains *volatile oil* and occasionally *cinnamic* acid ($C_9H_8O_2$). Samples containing the latter should be rejected (U. S. P.).

EFFECTS AND USES.—This drug owes its virtues chiefly to benzoic acid, which will be considered under the head of Antiseptics. Benzoin is a *topical* irritant, and after absorption, *stimulates* the broncho-pulmonary and other mucous membranes. It resembles myrrh in its effects, but is rather more acrid and stimulating. It is adapted to chronic bronchial affections, but is seldom employed alone. As a fumigation in *chronic laryngitis* it has been recommended by Trousseau and Pidoux. It is also used in *chronic cystitis* when the urine is alkaline and deposits phosphates, but the benzoates, especially ammonium benzoate, are more adapted to these cases.

ADMINISTRATION.—Dose, gr. x–xxx. The *tincture of benzoin* and the *compound tincture* (containing benzoin, purified aloes, storax and balsam of tolu dissolved in alcohol, and known as Friar's Balsam) are used as stimulating expectorants and in bowel complaints; dose, f℥ss–ij. As benzoin has the property of obviating the rancidity to which lard is liable, this is a very useful vehicle for medicated ointments. *Adeps benzoinatus* consists of benzoin, 2 parts, and lard 100 parts. Benzoin is much used in the form of fumigating pastiles.

STYRAX—STORAX.

Storax is a BALSAM prepared from the BARK of Liquidambar orientalis (*Nat. Ord.* Hamamelaceæ), a native of Asia Minor.

PREPARATION.—It is obtained by steaming the bruised bark and then expressing it, and occurs as a soft, viscid, brownish mass of the consistence of honey, yet more or less tenacious, of a fragrant odor and a warm taste.

CHEMICAL CONSTITUENTS.—It contains *storesin*, an amorphous substance—the most abundant constituent—an oil termed *styrol* (C_8H_8) (not always present), *resin*, *cinnamic acid* (and is therefore a balsam), and an *essential oil*. Alcohol and ether are its proper solvents. It is almost always more or less adulterated.

Effects and Uses.—It is used as a *stimulant expectorant* chiefly in the compound tincture of benzoin; dose, gr. x–xx.

BALSAMUM PERUVIANUM—BALSAM OF PERU.

Balsam of Peru is a balsam obtained from Myroxylon Pereiræ (*Nat. Ord.* Leguminosæ), a tree of Central America (Salvador).

Preparation—It is obtained from incisions in the bark, and is collected on rags inserted in the openings, which are afterward boiled in water, when the balsam settles at the bottom, and the water is poured off. A *white* balsam, obtained from the fruit of this tree by expression, and a tincture of the fruit in rum, are also known in Central America. Balsam of Peru has the consistence of honey, a dark, reddish-brown color, a pleasant smell, a warm, bitterish, acrid taste, and is soluble in alcohol and partially so in boiling water. It is heavier than water.

Chemical Constituents.—Its constituents are *cinnamein* (benzylic cinnamate, a colorless aromatic oil), *resin*, *benzalcohol*, *benzylic benzoate*, *stillbene*, and *cinnamic* and *benzoic acids*.

Effects and Uses.—It is a *stimulating blennorrhetic* and *tonic*, employed occasionally in *chronic bronchitis*, *asthma*, *gonorrhœa*, and *leucorrhœa*, but not much used in this country. *Externally* it is applied to indolent *ulcers*, as a surgical dressing.

Administration.—Dose, f℥ss in emulsion.

BALSAMUM TOLUTANUM—BALSAM OF TOLU.

Balsam of Tolu is a balsam obtained from Myroxylon toluifera (*Nat. Ord.* Leguminosæ), a tree of the neighborhood of Carthagena.

Preparation.—It is procured from incisions in the trunk of the tree, and concretes in the vessels in which it is received. It has a soft tenacious consistence, varying with the temperature, and by age becomes hard and resin-like. It is shining, translucent, of a reddish-brown color, a fragrant odor and a warm, sweetish, pungent taste, inflammable, entirely soluble in alcohol and the essential oils, and, like the other balsams, yields its acid to boiling water.

Chemical Constituents.—Its ingredients are *resins*, *benzylic benzoate* (a colorless aromatic oil), *benzylic cinnamate*, *tolene*, and *cinnamic* and *benzoic acids*.

Effects and Uses.—It is a *stimulant blennorrhetic* and tonic, useful in *chronic catarrhal affections*, and, from its agreeable flavor, much employed as an ingredient of cough-mixtures. The vapor of an ethereal solution of this balsam is inhaled with advantage for the relief of *cough*.

Administration.—Dose, gr. x-xxx, in emulsion, frequently repeated. The *tincture* (*tinctura tolutana*) is added to cough-mixtures; dose, f ʒj-ij. The *syrup* (*syrupus tolutanus*) is used as a vehicle for other medicines. Balsam of tolu is an ingredient of the *compound tincture of benzoin*.

The following gum-resins, previously noticed among *antispasmodics*, are employed as *expectorants*:—

Asafœtida (*Asafetida*). (See p. 121.)
Ammoniacum (*Ammoniac*). See p. 123.)
Galbanum. (See p. 123.)

ORDER VI.—EMMENAGOGUES.

Emmenagogues (from ἐμμήνια, the *catamenia*, and ἀγωγός, *exciting*) are medicines which promote the menstrual discharge. This discharge may be suppressed from various causes, and hence very opposite classes of remedies are employed to restore it. Thus, when amenorrhœa depends on *anemia*, the preparations of iron are the most effectual emmenagogues; on the other hand, when it occurs in connection with *plethora*, blood-letting and evacuants are resorted to. There are probably no articles which exert any specific influence upon the catamenia, as the discharge from the uterus is not one of the excretions through which medicinal agents pass out of the system. Medicines, however, which excite the pelvic circulation and stimulate the organs in the neighborhood of the uterus have a tendency to increase or excite the menstrual discharge. They are—

1. The *mild acrid cathartics*, as Aloes, etc.
2. Many of the *stimulating diuretics*, particularly Cantharides.
3. Some of the *blennorrhetics*, particularly Senega.
4. Guaiacum, usually classed with the *diaphoretics*.

Indirectly, the menstrual discharge is frequently promoted by—

1. *The preparations of Iron and of Manganese* (especially *Potassium Permanganate*), which are the best emmenagogues in chlorotic and anemic cases.
2. *Mercurials*, which prove emmenagogue from their influence in exciting the secretions generally.

The following articles are employed exclusively as emmenagogues:—

SABINA—SAVINE.

Savine is the TOPS of Juniperus Sabina (*Nat. Ord.* Coniferæ), a small evergreen bushy shrub of the south of Europe. They resemble closely the tops of *Juniperus virginiana*, the indigenous *Red Cedar*, which are sometimes substituted for savine in the shops. The latter has a greenish color, a strong, peculiar, heavy odor and a bitter, nauseous, resinous taste. Its virtues depend on a *volatile oil*, which is official.

PHYSIOLOGICAL EFFECTS.—Savine is a *local* irritant. Taken *internally*, in medicinal doses, it stimulates the circulation and secretions, with a very decided secondary action on the uterus. In large doses it will cause vomiting, purging, abdominal pain, suppressed or bloody urine, with symptoms of nervous depression, as shown in unconsciousness, stertorous breathing, perhaps convulsions, and death, usually from collapse.

TOXICOLOGY.—Fatal* results have occurred in several cases from its use to provoke premature labor. Toxic amounts induce violent gastro-enteritis.

MEDICINAL USES.—Savine is employed *internally* almost exclusively as an emmenagogue in *amenorrhœa*, and it is considered one of the best medicines that can be used to stimulate the action of the uterine vessels, and its physiological action is intensified by combination with oil of rue. Pereira† pronounces it "the most certain and powerful emmenagogue of the whole Materia Medica." It has been successfully used in *menorrhagia* depending on relaxation of the uterine tissues. *Topically*, it is used to keep up the discharge from blisters, to destroy *warts*, etc.

ADMINISTRATION.—Dose, in powder, gr. v-x; but it loses much of its oil by drying; of the *fluid extract* the dose is ♏v-x. *Ceratum sabinæ* (fluid extract, 25 parts, resin-cerate, 90 parts) is used to make perpetual blisters.

Oleum Sabinæ (*Oil of Savine*) ($C_{10}H_{16}$) is the preparation principally used *internally*. Dose, gtt. v-x—in capsules, pill or emulsion.

Oleum Rutæ (*Oil of Rue*) is a volatile oil distilled from Ruta graveolens (*Nat. Ord.* Rutaceæ), a perennial European plant, with tripinnate leaves, obovate leaflets and yellow flowers. The oil is a colorless or greenish-yellow liquid, of a characteristic, aromatic odor, a pungent, bitterish taste and a neutral reaction. It consists chiefly of *methyl-nonyl-ketone* ($CH_3.CO.C_9H_{19}$).

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* "A Treatise on Poisons," 4th ed., p. 605. Christison.

† "Mat. Med. and Therap.," 4th ed., p. 332.

TOXICOLOGY.—Two cases of non-fatal poisoning from an unknown quantity of decoction of the root, in females, followed by miscarriage, are recorded.*

EFFECTS AND USES.—Its action is *similar* to that of oil of savine, but is less powerful. It is prescribed in *hysteria* and *amenorrhœa*.

ADMINISTRATION.—Dose, gtt. ij-v every 3 or 4 hours.

TANACETUM—TANSY.

Tansy is the LEAVES and TOPS of Tanacetum vulgare (*Nat. Ord.* Compositæ), an herbaceous, perennial plant, indigenous to Europe but cultivated in our gardens and growing wild about waste places.

DESCRIPTION.—The leaves are bipinnatifid, the segments cut-toothed, smooth, dark green; the heads yellow, in a dense corymb, appearing in summer; the odor is strongly aromatic and the taste pungent and bitter.

CHEMICAL CONSTITUENTS.—It contains a *volatile oil, tanacetin* (a bitter-principle), *resin*, *tannin*, etc.

PHYSIOLOGICAL EFFECTS.—When the oil is given to animals in large doses, it causes vomiting, dilated pupil, muscular twitchings, followed by clonic convulsions and a cataleptic state with death from paralysis of the respiratory muscles. The lungs are found engorged, the left side of the heart empty and the kidneys much congested. In man, small doses induce a sensation of heat in the epigastrium flushing of face, giddiness and diuresis. In *toxic* doses it causes burning pain, vomiting and sometimes purging, loss of consciousness, violent convulsions of cerebral origin and death from respiratory paralysis.

TOXICOLOGY.—Grave symptoms have been produced by gtt. xv of the oil; but as recovery took place after ʒjss had been taken the precise fatal dose is not known. An unknown but large quantity of tansy-infusion† taken by an adult negress to produce abortion caused her death, the symptoms being incoherence of speech, contracted pupils, hebetude, and finally paralysis of the voluntary muscles, including those of deglutition, and lastly coma. The uterus was not affected, and stimulants failed to arouse her.

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* "Woodman and Tidy," 1882, p. 358.

† *Med. Times and Gazette*, April, 1861, p. 377.

Medicinal Uses.—It has been *employed* as a stimulating emmenagogue, but is an unsafe remedy. It has also been used to produce abortion, taken with criminal intent.

Administration.—Dose, of the powder, gr. x-xxx in infusion; of the oil, ♏j-ij.

The following unofficial drugs enjoy a reputation as emmenagogues:

Apiol or Parsley Camphor is obtained from the volatile oil of the root of Petroselinum sativum (*Nat. Ord.* Umbelliferæ). It occurs as a colorless or yellowish oil, having a strong odor of parsley and a pungent taste, and is soluble in alcohol, ether and chloroform, but not in water. It is said to be a mixture of several constituents (Maisch).

Effects and Uses.—It has been used in *amenorrhœa* of functional origin, especially when due to anemia, and is believed to be a stimulant to the ovaries. In neuralgic *dysmenorrhœa*, it has also been given with success. It is prescribed in doses of gtt. v-vj enclosed in gelatin-capsules, morning and evening for four or five days before the expected menstrual period.

Polygonum Hydropiperoides (*Water-Pepper* or *Smartweed*) (*Nat. Ord.* Polygonaceæ) is an indigenous *herb*, growing abundantly in moist places, with lanceolate, minutely pellucid-punctate leaves, and slender spikes of greenish or whitish flowers. It contains *polygonic acid*, etc.

Effects and Uses.—When applied *locally*, it is an irritant, exciting inflammation and vesication if rubbed on the cutaneous surface. *Internally.*—It is a *cardiac stimulant*, *diaphoretic*, *diuretic* and *expectorant*, stimulating the menstrual flow, and it is aphrodisiac; in large doses it causes nausea, vomiting and purging.

It is strongly recommended by Dr. Eberle in functional *amenorrhœa* and by others in functional *impotence*, and Dr. B. Woodward has used it with advantage in *diarrhœa* and *dysentery*. It has also been given as a diuretic to promote the expulsion of small *renal calculi* from the kidney and in *gravel*, and *locally* as a counterirritant.

Administration.—A fluid extract is used in doses of ♏x-f℥j.

CLASS III.—HEMATICS.

ORDER I.—HEMATINICS.

This order (from *αἱματίνα*, the *red coloring matter of the blood*) includes only the Preparations of Iron, or Chalybeates. The chalybeates increase the number of blood-corpuscles, or the amount of hematin in the blood, and are employed therapeutically in diseases dependent on a deficiency of these elements. They belong eminently to *hematics* (or medicines which occasion changes in the condition of the blood); but as they possess also general and local tonic effects, independent of their action on the blood, they have been classed and treated among the *mineral tonics* (see page 164).

ORDER II.—ALTERATIVES.

Alteratives may be defined to be medicines which produce such a modification of the nutritive processes as enables the vital principle to restore healthy action in morbid conditions of the system. The *modus operandi* of these medicines is not understood. Perhaps their effects are owing to a correcting influence on the quality of the circulating fluid (thus, in inflammations they may act by diminishing the abnormal quantity of fibrin in the blood, rendering its red corpuscles less disposed to aggregation, and decreasing the number and adhesiveness of its white globules); perhaps their curative operation is of a *substitutive* character (by setting up an *antagonistic* action which takes the place of diseased action in the system); or perhaps they may attack diseased cells, causing their disintegration and rapid removal from the body by means of the excretions.

Under the influence of alteratives the secretions and exhalations are increased, the textures softened, and morbid growths and deposits are absorbed. The exudation of plastic or coagulable lymph is checked, and, as a consequence, also the formation of false membranes, and visceral and glandular enlargements and indurations are diminished and often disappear.

If pushed too far, the alteratives soften and even destroy the textures, impoverish the blood so as to interfere with the functions of nutrition, and produce a condition of marasmus and cachexia.

Their principal therapeutic employment is as *antiphlogistics* or *resolvents*. The *mercurials* are chiefly employed in *acute* inflammations; the preparations of *iodine* in *chronic* inflammations. Mercurials are used in acute sthenic inflammations, especially in such as have a tendency to terminate in effusions of lymph which would seriously interfere with the function of the part, by forming adhesions or false membranes. The iodic preparations are adapted to inflammations of a chronic character, and are particularly serviceable in indurations or enlargements of glands and organs, and in affections of the bones and fibrous tissues.

Owing to the injurious results which follow the prolonged exhibition of alteratives, they are to be administered with caution, and their effects closely watched.

HYDRARGYRI PRÆPARATA—PREPARATIONS OF MERCURY.

Metallic mercury or quicksilver is obtained principally from the red sulphide (*cinnabar*). The chief supply of quicksilver was long derived from Spain and Austria, but the markets of the United States are now furnished from New Almaden, in California. Mercury is an odorless, tasteless, volatile, liquid metal, of a whitish color. Its atomic weight is 199.7; its symbol is Hg.

INCOMPATIBLES.—The chlorides and nitro-hydrochloric acid are incompatible with the metallic preparations of mercury.

AIDS.—Such purgatives as aloes and podophyllum enhance its cathartic action; as an antisyphilitic, potassium iodide; sedative agents, as antimony, promote its depressant action.

CONTRAINDICATIONS.—Mercurials are contraindicated in all asthenic inflammations, in renal disease or tuberculosis; or where much debility exists. Even if such be distinctly referable to syphilis, caution must be enjoined in their use.

PHYSIOLOGICAL EFFECTS.—While it retains the liquid metallic state, mercury is inert; but when taken *internally* it combines in the stomach and alimentary canal to form soluble and absorbable compounds—perhaps with the sodic chloride and albumen there present—and thus becomes active. In the blood it is said to exist as an oxy-albuminate. In the state of vapor it frequently proves injurious, in some instances exciting salivation, ulceration of the mouth, etc., in others inducing a peculiar affection of the nervous system termed *shaking palsy* (*tremor mercurialis*), which is often attended with loss of memory, vertigo and other evidences of cerebral disturbance, and sometimes terminates fatally. Workmen in quicksilver are liable to this affection. It is supposed by some chemists that the activity of mercurial emanations is owing to the oxidation of the metal before it is inhaled; by others, that, in the finely-divided state in which it exists as a vapor, it is in itself poisonous.

All the compounds of mercury possess activity. Some of them are violent caustic poisons, all of them are more or less irritant. When the mercurials are taken *internally* their effects vary with the quantity administered. In *small* and *repeated* doses, their influence is first shown in an increase of the activity of the secernents and exhalants. The cutaneous, mucous, biliary, salivary, urinary, and probably also the pancreatic secretions are all increased in amount, and at the same time the absorbent system becomes more active, so that the accumulation of fluids, morbid enlargements, indurations, etc., will often disappear. It is by augumentation of the secretions of the intestinal appendages that the mercurials prove purgative.

Mercury increases the flow of bile. Most of the mercurial preparations probably accomplish this merely in a mechanical manner, *i. e.*, by causing reflex contraction of the gall-bladder and ducts, due to the irritation of the mucous membrane of the duodenum; but corrosive sublimate would seem, from the experiments of Rutherford and Vignal, to have considerable power as a stimulant of the hepatic secretory apparatus.

When the mercurials are given in *larger doses* and for a period varying in length according to the susceptibility of the individual, these effects are more intense. The proportion of red corpuscles* is diminished. The mucous membrane of the mouth and the salivary glands not only take on increased secretory action, but become irritated and inflamed. The gums first show the mercurial influence, and are tender and tumefied; the whole mouth soon becomes sore; the tongue is swollen; and the saliva and buccal mucus flow abundantly, sometimes to the extent of several pints a day. At the same time the breath acquires a peculiar fetidity, and the patient perceives a metallic taste in the mouth. The *resolvent* action of the mercurials is now still more obvious than when its impression is milder, and considerable emaciation usually ensues from interference with nutrition and the absorption of fat. Formerly these effects, which are termed *sialagogue* (from the excessive flow of saliva), were commonly produced for the cure of disease, and, as a general rule, gradually subsided, leaving the health much impaired. When, however, the use of the mercurials is pushed too far, or it is administered to persons peculiarly susceptible to its action, a train of very serious symptoms ensues—as excessive salivation, ulceration of the mouth, sloughing of the gums, loosening of the teeth, and occasionally necrosis of the alveolar processes. A peculiar febrile condition called *mercurial fever*, diarrhœa, skin-diseases, neuralgia, rheumatism, disorder of the nervous system, and marasmus, are other symptoms which are frequently noticed after the abuse of mercury.

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* "Report of Edin. Committee on the Action of Mercury on the Biliary Secretions," 116, 2d ed., 1874. Hughes-Bennett.

After their absorption the mercurials (and there is no doubt that they are absorbed,* since they have been found in the blood, saliva, liver, etc.) produce several important changes in the quality of the blood. Exceedingly minute doses given for some time, but not too frequently repeated, increase the proportion of red corpuscles in this fluid, and the bodily weight. This has been proven by Schlesinger† in an elaborate series of investigations upon dogs. Immediately upon the establishment of salivation, the blood exhibits an increase in the quantity of fibrin and red corpuscles; but at a later period it loses color, consistence and coagulability, and the relative proportion of albumen, fibrin and corpuscles is diminished. This *antiplastic* action on the blood renders the mercurials invaluable as antiphlogistic remedies. They are in part eliminated by the urine, feces and saliva. In the feces they pass out as a sulphide.

Toxicology.—A non-fatal case in which ℥ivss of quicksilver was taken to produce abortion is reported by Sir G. D. Gibb,‡ the chief symptom being trembling palsy; there was no salivation, coloration on the gums or action on the uterus.

Antidotes.—If salivation or ulceration occur, the drug must be stopped and astringent gargles, as brandy and water, solutions of chlorinated soda or lime, alum, etc., may be employed. In cases of sloughing sores, silver nitrate, or the mineral acids should be applied. Gastro-enteric irritation is to be treated with laxatives and opiates. The mercurial cachexia requires change of air, generous diet, tonics, etc. When the system is contaminated with mercury, it may be eliminated by the use of potassium iodide, which forms soluble compounds with the mercury retained in the economy.

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* "Mat. Med. and Therapeutics," Stillé, II, 1860, 782, quoted.

† *Arch. für exper. Path. u. Pharmak.*, XIII, 317.

‡ *The Lancet*, London, 1873, p. 339.

Medicinal Uses.—Liquid metallic mercury was formerly administered to remove mechanical obstructions of the bowels, but its use has been abandoned. The preparations of mercury are employed therapeutically with various objects :—

1. As indirect tonics and cholagogues—with a view to their action on the secretions—in dyspepsia and constipation accompanied with torpor of the liver, in gout, rheumatism, chronic skin diseases, etc. Blue pill, mercury with chalk, and calomel, are employed with this view: the two former are preferred as least irritating.

2. As antiphlogistics.—Mercury was formerly given in nearly all cases of sthenic inflammation with a tendency to plastic effusion. At present, however, its use as an antiphologistic is principally restricted to acute inflammation of the serous membranes of sthenic type during the stage of exudation, and after the plastic effusion has ceased to be poured out with a view to prevent its organization and facilitate absorption. In this way it is given in pleuritis, pericarditis and peritonitis, and with a similar view in pneumonitis, and iritis. Many writers, however, relying on other remedies, deprecate the use of mercurials in the treatment of these diseases, with the exception of iritis, in which they are universally acknowledged to be of benefit. Minute doses of the mercurials, frequently repeated, are highly recommended in acute glandular affections about the throat and neck, as tonsillitis, parotitis, etc. In acute sthenic dysentery, a mercurial—especially calomel—may often be given with advantage. When given with a view to their antiplastic effects, it is no longer thought necessary to cause profuse salivation; it is sufficient to produce the constitutional effects as manifested by a metallic taste in the mouth, very slight tumefaction of the gums and slight tenderness of the teeth when knocked together forcibly. During the maintenance of this condition the patient should use warm clothing, avoid exposure to cold, and take light and nourishing food.

3. As antisyphilitics.—Mercury has long been regarded as the only reliable syphilitic agent. So far no satisfactory explanation has been made as to its mode of action. Hughes-Bennett (*loc. cit.*) and Wilbouchewitch* have shown that the blood of syphilitics who

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* *Arch. de Physiol. Norm. et Pathol.* 2d ser., 1, 1874, 509.

were taking mercury underwent an increase in the number of red globules. It has no direct curative influence on the primary symptoms; but after the system has been contaminated with the syphilitic virus, mercury is the most certain and rapid means of destroying it. Formerly, wherever the chancre, with distinct induration (which is indicative of constitutional taint), was present, the mercurials were administered, but, as it is now generally conceded that the initial lesion is but a *local manifestation* of a *constitutional disease*, in other words, that the patient's system is affected with the disease, when the chancre first appears, and as mercury does not prevent the secondary symptoms, but merely modifies them in such a manner that no prognosis can be formed from the variety or date of appearance of the syphilides, it is recommended to withhold mercurials until the secondary lesions manifest themselves (H. Morris). Some high authorities, however, adhere to the rule of administering mercury from the first appearance of the chancre. Hutchinson's* "abortive treatment of syphilis" consists in the administration of gray powder (*q. v.*) as soon as the diagnosis is verified by the induration around the sore, for the purpose of entirely suppressing the secondary symptoms. He believes mercury is antagonistic to the microbe of syphilis. Von Zeissl's† teaching is to wait eight or ten weeks after the first eruption has appeared, and then to give it by inunction. I do not agree with this doctrine, for it seems irrational to allow the disease to gain so much headway (C. Biddle). Ross‡ advises it to be given "when the base of the primary ulcer is thickened," as it stimulates the tissues surrounding the ulcer to increased action, but he offers no evidence to prove the latter statement. I am of opinion that as soon as the diagnosis of syphilis is positively made certain, and in this statement I am in accord with the view of Verneuil,§ and Hutchinson (*loc. cit.*), by the character of the ulcer, its period of incubation, the presence of a non-suppurating bubo, and possibly by confrontation, it is time to begin a mercurial course, small in dose, continued usually for a lengthy period (two and a half years), occasionally intermitted, and in semi-metallic form, as blue mass or gray powder (C. B.). In the treatment of hereditary syphilis, a mercurial course is indispensable. In tertiary syphilis, small doses of corrosive sublimate are often combined with potassium iodide with better effects than when the iodide is given alone; after the tertiary symptoms have disappeared the mercurials should be continued for eighteen months, with the occasional intermission of the treatment for two or three weeks. Mercurials may be used not only internally, but by *inunction* and by *fumigation*, for Dr. Fürbringer has shown that, although metallic mercury will not pass through the skin, yet when rubbed into the sebaceous follicles the sebaceous matter converts it into a soluble mercurous compound, which is then readily absorbed; and by *hypodermic injection.*

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* *Lancet*, Feb., 1888, p. 372.
† "Path. and Treat. of Syphilis," 1886, p. 335.
‡ *The Practitioner*, V, p. 220.
§ *Bull. Gén. de Thérap.*, Oct., 1887.

Blue pill and calomel are the *antiplastics* principally resorted to; as *antisyphilitics,* both the iodides, corrosive sublimate, gray powder and calomel are employed. In administering mercurials for their sialagogue action, we sometimes observe a *cumulative* effect; they may be exhibited, particularly to children, for some time without result, when suddenly the most violent symptoms of mercurial saturation will be developed.

4. AS PURGATIVES.—The employment of calomel and blue pill, as cathartics and anthelmintics, has been previously noticed (see index).

The following are the preparations of mercury which are employed medicinally:—

1. METALLIC MERCURY.—When intimately mixed with pulverulent or fatty bodies, mercury loses its liquid character—is said to be *killed, extinguished* or *mortified*—and acquires medicinal activity. Its activity is probably owing to its reduction to a state of minute division, which enables it to enter into combinations in the stomach. As more or less oxidization has always taken place in the metallic preparations before use, their composition is uncertain. The official preparations of metallic mercury are: *Massa hydrargyri* (*mass of mercury*), *unguentum hydrargyri* (*mercurial ointment*), *emplastrum hydrargyri* (*mercurial plaster*), *emplastrum ammoniaci cum hydrargyro* (*ammoniac plaster with mercury*), *hydrargyrum cum cretâ* (*mercury with chalk*).

2. OXIDES.—*Hydrargyri oxidum flavum* (*yellow mercurial oxide*) *unguentum hydrargyri oxidi flavi* (*ointment of yellow mercurial oxide*), *oleatum hydrargyri* (*oleate of mercury*), *hydrargyri oxidum rubrum* (*red mercurial oxide*), *unguentum hydrargyri oxidi rubri* (*ointment of red mercurial oxide*).

3. CHLORIDES.—*Hydrargyri chloridum mite* (*mild mercurial*

chloride, or *calomel*), *hydrargyri chloridum corrosivum* (*corrosive*, or *mercuric chloride*, or *corrosive sublimate*).

4. IODIDES.—*Hydrargyri iodidum viride* (*green mercurial iodide*) *hydrargyri iodidum rubrum* (*red mercurial iodide*).

5. *Hydrargyri cyanidum* (*mercurial cyanide*).

6. *Hydrargyrum ammoniatum* (*ammoniated mercury*), *unguentum hydrargyri ammoniati* (*ointment of ammoniated mercury*).

7. *Hydrargyri subsulphas flavus* (*yellow mercurial subsulphate*).

8. *Hydrargyri sulphidum rubrum* (*red mercurial sulphide*).

9. NITRATES.—*Unguentum hydrargyri nitratis* (*ointment of mercurial nitrate*), *liquor hydrargyri nitratis* (*solution of mercurial nitrate*).

Massa Hydrargyri (*Mass of Mercury*). This preparation, generally known as *blue mass*, is made by rubbing mercury (33 parts) with honey of rose (34 parts) and glycerin (3 parts) till all the globules disappear; then adding powdered glycyrrhiza (5 parts) and althæa (25 parts), and beating the whole into a mass. The trituration is now generally effected by machinery—usually by steam-power. It is a soft, dark-blue mass, of a convenient consistence for making it into pills. The mercury is in a state of minute division, and is chemically unaltered, though, perhaps, a very small portion of it is in a state of oxidation. The preparation changes color from being kept, becoming of an olive and even reddish tint, in consequence of the further oxidation of the metal. As it is often adulterated, it is important that it should be purchased of a reliable house.

TOXICOLOGY.—In the case of an adult female,* gr. xviij caused death, the chief symptom being profuse salivation—a very exceptional instance.

EFFECTS and USES.—In full doses (gr. v–xv) blue pill acts as a *laxative*; when given for this purpose it is usually followed in a few hours by a saline cathartic. This plan is very efficient in *migraine* and *biliousness*. In doses of gr. j–ij–iij, repeated at proper intervals, it is employed as an *alterative* or *antiphlogistic*. When it moves the bowels, opium is combined with it. It may be pleasantly given suspended in mucilage or syrup. Blue mass is an efficient *antisyphilitic agent*, and is often well combined with iron and quinine as in the following prescription: ℞ Massæ hydrargyri, gr. ¼–½; ferri sulphatis exsiccati et quininæ sulphatis, āā gr. j; extracti opii, gr. ⅛. M. et ft. pil. j. Sig.—One pill half hour after meals; it has the advantage also of being in the metallic state, which was the form preferred by the late Dr. Bumstead.

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* *The Lancet*, 1838, 215.

Unguentum Hydrargyri (*Mercurial Ointment*) (also called *blue ointment*) is made by rubbing mercury with compound tincture of benzoin and mercurial ointment, then adding suet and lard, previously melted together, and continuing to rub until the globules disappear. It is an unctuous, fatty body, of a bluish-gray color, consisting of equal weights of *fatty matter* and finely divided *mercury*. A very small portion of mercurous oxide is perhaps present, and, as the ointment becomes darker by age, a further oxidation of the mercury probably takes place.

EFFECTS AND USES.—Mercurial ointment, when either swallowed or rubbed into the integument, slowly produces the constitutional effects of mercury; *locally*, it has but little irritant effect. It is scarcely ever used *internally* in the United States or Great Britain, though in France it is highly esteemed as a sialagogue, in the dose of gr. ij, repeated. *Externally* it is used to mercurialize the system by friction; to disperse *non-malignant tumors;* as a dressing to *syphilitic sores;* to destroy *pediculi;* and to prevent the suppuration and pitting of *smallpox*. When mercurial *inunction* is about to be practiced in the treatment of *secondary syphilis*, the part to which the ointment is to be applied should be washed with castile-soap and warm water to free the skin from oily matters. Sigmund, of Vienna, the great advocate for this plan of treatment, recommends that the inunctions (gr. xx. ʒss.), be applied to different parts of the body; thus, during five successive nights this treatment would be practiced on the legs, on the thighs, on the abdomen and sides of the chest, on the back, on the arms, and on the sixth night he would apply the inunction to the legs again. The rubber should wear a glove to guard against the absorption of mercury. This plan of treatment is troublesome and filthy, and has not been generally used, but in certain cases, where mercury cannot be taken internally, or does not effect a cure, it is of much value. During the course the patient should remain indoors and keep at rest upon a sofa. Another method is to thoroughly rub the ointment into the soles of the feet every night for a week, when the inunction should be omitted for three nights, after which the process may be repeated. About gr. xv–xxx are required each night, and it is best to apply it to the feet alternately.

Emplastrum Hydrargyri (*Mercurial Plaster*) is made by rubbing 30 parts of mercury with 10 parts of olive-oil and resin each, previously melted together, till the globules disappear, and then adding 50 parts of melted lead-plaster. It is used as a discutient of *scrofulous* and *syphilitic enlargements*, to *enlarged joints*, to prevent pitting in *smallpox*, etc., and is applied to the side in *chronic hepatitis;* it may induce salivation. The *plaster of ammoniac with mercury* (*emplastrum ammoniaci cum hydrargyro*) is more stimulating than the foregoing.

Hydrargyrum cum Cretâ (*Mercury with Chalk*) (called also *gray powder*), is prepared by rubbing 38 parts of mercury with 50 parts of *prepared chalk* and 12 parts of sugar of milk, till all the globules disappear. It is a grayish powder, containing mercury chiefly in a state of minute division.

Effects and Uses.—In full doses it is a gentle laxative, milder even than blue pill; in smaller doses it is an excellent alterative; and the chalk renders it antacid. It is employed in infantile cases chiefly as an alterative. In *congenital syphilis* gr. ¼ may be given three times a day. Gray powder is Mr. J. Hutchinson's* favorite remedy in secondary *syphilis*, as follows: ℞ Hydrargyri cum cretâ, pulveris ipecacuanhæ et opii, āā gr. j. M. et ft. pil. 1. Sig.—One every 6, 4, 3, or even 2 hours. He advises this preparation of mercury to be used for a long period, but always in small doses.

Administration.—Dose, for adults, gr. v–xx; for children, gr. ij–iij to gr. viij–x in *powder*, and not in pills, as in the latter form the mercury becomes squeezed out of the chalk.

Hydrargyri Oxidum Rubrum (*Red Mercuric Oxide*) (HgO). It is made usually by dissolving mercury in diluted nitric acid, with a gentle heat, by which mercuric nitrate is formed; and the nitric acid is afterward decomposed and driven off by calcination. The mercuric oxide, commonly called *red precipitate*, occurs in small, shining scales, of a brilliant red color, with a shade of orange. It has an acrid taste, and is nearly insoluble in water. Its effects are those of a powerful irritant, and when taken internally, even in small doses, it excites vomiting and purging; in large doses, gastro-enteritis.

Toxicology.—An instance of non-fatal poisoning† is recorded in the case of a female aged 15, who swallowed probably ℥½, the ingestion of which was only followed by some abdominal pain, mercurial fetor of breath, sore mouth and gums.

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* "On Syphilis," 1887, p. 51.

† *Irish Hosp. Gazette*, 1, 1873, p. 308.

EFFECTS AND USES.—It is rarely or never used internally; *externally* it is applied as an escharotic, either in powder or ointment, to *chancres*, indolent *ulcers*, etc.

ADMINISTRATION.—Dose gr. $\frac{1}{16}$—$\frac{1}{8}$; *unguentum hydrargyri oxidi rubri* (*ointment of red mercuric oxide*) consists of red oxide (10 parts) mixed with ointment (90 parts); it is a very useful stimulating ointment in indolent *ulcers* and *porrigo.*

Hydrargyri Oxidum Flavum (*Yellow Mercuric Oxide*) is made by mixing a solution of corrosive sublimate with solution of potassa; potassium chloride is formed in solution, and mercuric oxide (HgO) is precipitated as an orange-yellow powder, which, on being heated, assumes a red color. The yellow oxide is without odor, of an acrid taste, is very slightly soluble in water, and is insoluble in cold alcohol and ether.

EFFECTS AND USES.—This preparation is preferred for some purposes to the *red oxide*, owing to its greater purity, and especially to its occurring in the form of a *completely amorphous powder*, exhibiting no evidence of crystalline particles even under the microscope. This gives it a superiority, as a local application to the conjunctiva, in diseases of the eye, over the *red oxide*, which, from the *crystalline* character of its particles, causes more or less irritation. *Unguentum hydrargyri oxidi flavi* (*ointment of yellow mercuric oxide*) consists of yellow oxide, 10 parts, mixed with ointment, 90 parts; an efficient application in *opacity* and *ulcer of the cornea*, to remove the granulations of *ophthalmia*, and to the margin of the lid in *blepharitis* after the removal of the crusts. *Oleatum hydrargyri* (*oleate of mercury*) consists of yellow oxide, 10 parts, dissolved in oleic acid, 90 parts, by means of heat. In the treatment of *secondary syphilis* it may be used by inunction as a substitute for mercurial ointment. For this purpose 20 per cent. in solution should be painted on the part, or it may be mixed with petrolatum in the same proportion, and applied with mild friction. In infantile cases an ointment containing 5 per cent. of the oleate may be applied by means of roller bandages once a day. H. W. Stelwagon* finds the oleate inferior to blue ointment when applied locally for its constitutional effects, but lauds its use in *ring-worm* of the scalp. It is also useful to relieve *pruritus.*

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* *Am. Journ. Med. Sci.*, Oct., 1885.

Yellow wash (a favorite application to *phagedenic chancroids*) consists of yellow mercuric oxide suspended in a weak solution of calcium chloride, and is made by adding corrosive sublimate ʒj to lime-solution Oj. *Black wash* (a favorite application to *chancres, mucous patches, balanitis, herpes* and *prickly heat*) is an impure mercurous oxide (Hg_2O) in a weak solution of calcium chloride, and is made by adding calomel ʒj to lime-solution Oj. In the treatment of *vesicular eczema*, an efficient plan is to cleanse the parts with black wash, and then to apply zinc oxide ointment—all to be repeated according to circumstances.

Hydrargyri Chloridum Mite (*Mild Mercurial Chloride*). This preparation (mercurous chloride), well known as *calomel* (Hg_2Cl_2), is made by subliming a mixture of mercurous sulphate and sodium chloride (common salt); a double decomposition takes place, by which mercurous chloride and sodium sulphate are formed. The mercurous sulphate is previously obtained by boiling mercury in sulphuric acid, and afterward triturating the resulting mercuric sulphate with mercury. *Calomel*, as thus procured in mass, is liable to contain a little corrosive sublimate. It should be reduced to powder, and washed repeatedly with boiling distilled water until the absence of a white precipitate with ammonium hydrate shows that the corrosive sublimate has been removed. With a view of obtaining calomel in a state of very minute division, its vapor is condensed in a receiving vessel filled with steam, whereby it takes the form of a very fine powder, and is perfectly free from corrosive sublimate. The calomel thus prepared (known as *Jewell's* or *Howard's* calomel) is finer and more active than can be obtained by levigation and elutriation.

CHEMISTRY AND TESTS.—Calomel, as usually manufactured by sublimation, is in the form of white, fibrous, crystalline cakes. It may be obtained in the shape of quadrangular prismatic crystals. As found in the shops it is a light-buff or ivory-colored powder, tasteless, inodorous, insoluble in water, alcohol and ether, unalterable in the air, but blackening by exposure to light, showing decomposition. It should be kept in bottles painted black or covered with black paper. *Jewell's* calomel is a perfectly white powder. *Tests.*—*When pure*, calomel is completely vaporizable by heat; it strikes a black color, free from reddish tinge, with solutions of the fixed alkalies; and should not, when digested with water, form a white precipitate with ammonia, unless it contain corrosive sublimate.

Calomel is insoluble in ether, corrosive sublimate moderately soluble in this menstruum.

Incompatibles.—The alkalies, alkaline earths, alkaline carbonates, soaps, and sulphydrates are incompatible with calomel. Nitrohydrochloric acid should not be prescribed with it, for fear of generating corrosive sublimate. Preparations containing hydrochloric acid, and potassium, ammonium or sodium chloride, produce the same change.

Physiological Effects.—Calomel produces the *effects of the mercurials* already described, causing bilious stools, not from direct stimulatiom of the liver, but probably in a reflex manner; it stimulates too the intestinal glands, and in purgative doses proves a valuable anthelmintic. It agrees well with the stomach, and will often be borne when other purgatives would not be tolerated. It is asserted that calomel is converted into corrosive sublimate in the stomach by the hydrochlaric acid which it there encounters, but there are many reasons for rejecting this hypothesis, and more probably it unites with the albuminous peptones there present, forming a compound which is soluble in the gastric fluid.

Toxicology.—Calomel has been frequently taken in very large doses without any bad effects; but instances are recorded in which, in excessive quantity, it has acted as an irritant poison. In the case of a boy * aged 14, gr. vj, and in the cases of two lads † of 12 and 15, gr. xv caused death; but such examples must be considered as very unusual.

Medicinal Uses.—From the certainty and mildness of its operation it is more employed than any of the other preparations of mercury, although blue pill, which, if less certain, is milder, is preferred under some circumstances. As a *purgative* it is prescribed in doses, of gr. vj–xij in *fevers*, *enteritis*, *yellow fever*, and many other affections; gr. ss–j at bedtime will often prove sufficiently purgative in the morning; as an *anthelmintic*, against *round* and *thread-worms* in the same doses; and in both cases it is to be followed in a few hours by a saline draught, castor-oil or senna. Calomel is often given in combination with other cathartics, as jalap, rhubarb, aloes, scammony, colocynth and gamboge. In the treatment of *secondary syphilis* it is the favorite remedy of many, and may be given gr.

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* "Med. Jurisprudence," Taylor, 5th ed., p. 98.

† "A Treastise on Poisons," Christison, 4th ed., p. 428.

$\frac{1}{12}$, $\frac{1}{14}$, 3 to 4 times daily. As an *antiphlogistic* in *inflammatory cases*, calomel is given in doses of gr. ss–j every one, two or three hours; as an *eccritic*, in these doses twice or thrice a day. In the dose of gr. $\frac{1}{10}$–j, frequently repeated, it is one of the best means of checking obstinate *vomiting* and *nausea;* similar doses with sodium bicarbonate gr. j may be sprinkled on the tongue every half hour, which will often be of great service in the *gastric irritability* and *catarrh* following the ingestion of indigestible food, after the contents of the stomach have been evacuated; and in *cholera morbus*. In *jaundice* due to catarrh of the bile ducts calomel gr. $\frac{1}{12}$–$\frac{1}{6}$ every 3 or 4 hours may be given with advantage to allay irritation of the duodenal and biliary mucous membranes. It is sometimes added to other medicines to increase their action on the secretions, as to squill or digitalis, and has been lauded as a *diuretic* in cardiac dropsy. Cohn's * clinical investigations, however, have not led him to place much reliance on calomel as a diuretic in cardiac and other dropsies. As the diuretic action of the mercurial preparations seems to depend upon their stimulant action on the liver, leading to the increased formation of urea, as in the case of other cholagogues, † and as Rutherford has shown that calomel is not a true hepatic stimulant, it is probable that either some some of the corrosive chloride was present in the calomel, causing diuresis, or that the latter was transformed into that salt in the alimentary canal.‡ To children, calomel may be given in proportionally larger doses than to adults, and it rarely salivates them. In some cases of *infantile diarrhœa*, very minute doses of calomel, as gr. $\frac{1}{16}$, $\frac{1}{12}$, $\frac{1}{8}$, every hour or two, are highly efficacious. *Externally*, calomel is applied in powder, in *opacity of the cornea;* and made into an ointment (ʒj to ℥j lard), it is an excellent application in a variety of cutaneous affections, as *herpes*. It is also used in the treatment of *secondary syphilis* by *fumigation*. For this purpose calomel ʒss may be volatilized in a water-bath placed beneath a cane-bottomed chair on which the patient is seated, without his clothes, but wrapped to the neck in blankets which should envelop the chair and apparatus. The patient should sleep in the blanket in which he was wrapped during the fumigation.

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[*] "Ueber die diuret. Wirkung des Calomel," Inaug.-Dissert., Berlin, 1887.

[†] *Brit. Med. Journ.*, Feb., 1886, pp. 377 and 433. See abstract of Report by Dr. Noel Paton to Scientific Grants Committee of the British Medical Association.

[‡] *Practitioner*, Sept., 1886, Spiller Locke.

Hydrargyri Chloridum Corrosivum (*Corrosive Mercurial Chloride*). This is mercuric chloride, commonly called *corrosive sublimate* ($HgCl_2$). It is made by subliming a mixture of sodium chloride and mercuric sulphate (which is previously obtained by boiling mercury with sulphuric acid) double decomposition takes place, resulting in the formation of mercuric chloride and sodium sulphate.

CHEMISTRY AND TESTS.—Corrosive sublimate occurs in the form of white, semi-transparent, crystalline masses, permanent in the air, inodorous, and of an acrid, styptic taste. It is soluable in 16 parts of cold water or 2 parts of boiling water, more soluble in alcohol, and still more so in ether. The aqueous solution, when exposed to light, is decomposed, with the precipitation of calomel and evolution of hydrochloric acid. The *tests* for detecting corrosive sublimate in solution are: 1. A solution of potassa, soda or lime throws down a yellow precipitate; 2. Potassium carbonate, a brick-red precipitate; 3. Ammonia, white ammoniated mercury; 4. Potassium iodide, a bright scarlet-red mercuric iodide, readily soluble in excess of the precipitant; 5. Stannous chloride, in small amount, a white precipitate of calomel—in excess, a dark-gray precipitate of metallic mercury; 6. Sulphuretted hydrogen, or a sulphide, in minute amount, produces a whitish or gray precipitate, and in large amount a black sulphide; 7. If the solution be acidulated with hydrochloric acid and gently heated, bright *copper-foil*, when plunged into it, becomes coated with a silvery-white deposit of mercury; and the metal may be afterward obtained by sublimation in a test-tube in the form of globules. The above is the method of obtaining mercury from organic mixtures, and it will detect about $\frac{1}{100000}$ of a grain (Wormley*). The deposit on the copper-foil must be distinguished from deposits of arsenic and antimony, which are obtained in the same way. Under the microscope the mercury sublimate appears to be globular, the antimony amorphous and the arsenic in octahedral crystals.

INCOMPATIBLES.—It is incompatible with many of the metals, the alkalies and their carbonates, soap, lime-solution, tartar emetic, silver nitrate, the lead acetates, potassium and sodium iodides, the sulphides generally, syrup of sarsaparilla, and with many vegetable substances (as the bitters) and albuminous liquids (as milk, etc.).

PHYSIOLOGICAL EFFECTS.—In medicinal doses, gr. $\frac{1}{16}$—$\frac{1}{8}$, corrosive sublimate occasions a beneficial alterative effect, without any obvious activity. It is a true hepatic stimulant of considerable power, increasing also the formation of urea and uric acid, and thus acting as a diuretic,* and likewise feebly stimulating the intestinal glands. Its continued use may cause salivation, but it has less tendency to produce this result than any other preparation of mercury. Medicinal doses, if too large or too long continued, frequently produce gastro- enteric symptoms and the constitutional effects of mercury.

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* "Micro-Chemistry of Poisons," 1885, p. 352.

TOXICOLOGY.—In excessive doses corrosive sublimate is a violent *caustic poison*, from its affinity for the albumen, fibrin and other constituents of the tissues. It acts very rapidly, producing the most intense gastro-enteritis, with violent vomiting and purging, abdominal pain and tenderness, bloody stools, with death from collapse; or, after a time, with convulsions and coma. The urine is albuminous or bloody, diminished in amount or suppressed.

The precise *fatal quantity* cannot be stated, for in a number of cases the toxic amount has varied widely; for instance, Taylor† reports the death of a child from gr. iij; Herapath‡ records a fatal case from gr. xx in solution, in the case of a man; while a girl§ of eighteen recovered after swallowing about gr. xix.

ANTIDOTES.—The best *antidote* is *albumen* (in the form of white of eggs); or, if this is not attainable, *gluten* (in wheaten flour) or *casein* (in milk) may be substituted. *Ferrous sulphide* (if given immediately), and a mixture of *iron-filings* (two parts) with *gold dust* (one part), also decompose corrosive sublimate. In cases of poisoning, the stomach must be evacuated as soon as possible, and the after-treatment consists in the free use of demulcents (linseed-tea, or mucilage of acacia), and opiates.

MEDICINAL USES.—Corrosive sublimate is used chiefly as an alterative or antagonistic agent in *secondary syphilis*, both by the stomach and occasionally by hypodermic injection; and also in cutaneous and rheumatic affections; it is a good remedy, too, in *chronic diarrhœa* and *dysentery* with slimy and bloody discharges. In *tertiary syphilis* it is combined advantageously with potassium iodide, as in the following: ℞ Hydrargyri chloridi corrosivi, gr. iss; potassii iodidi, ℨij; elixir aurantii, f℥ij; aquæ ad f℥vj. M.

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* *Practitioner*, Sept., 1886.

† "Medical Jurisprudence," 1865, p. 225.

‡ *The Lancet*, 1845, p. 650.

§ *Guy's Hosp. Reports*, 1851, p. 212.

Sig.—fʒij, in water, t. d., after meals. The dose, when alone, is gr. $\frac{1}{16}$—$\frac{1}{8}$ three or four times a day, after meals, in pill; or, if in solution, disguised by elixir of orange. It has also been used *hypodermically* in *syphilis*. For this purpose various solutions have been used. ℞ Hydrargyri chloridi corrosivi, gr. j; aquæ destillatæ, f℥j. M. Of this solution ♏x contain gr. $\frac{1}{48}$. As the injection of corrosive sublimate is followed, in many instances, by inflammation and abscess, and as it seems to have no decided advantage over the other methods, we do not advise its adoption.

When used hypodermically mercury is claimed to be more energetic, efficient, and rapid in its action than when administered either by the mouth, by inunction, or by fumigation.

M. Martineau, who has employed it largely in syphilis, declares there is neither pain, phlegmon, abscess nor stomatitis (without there was previously an unhealthy condition of the buccal mucous membrane), and no gastro-intestinal disturbance, when the solution is neutral, the needle fine and very sharp, and the injection made in the dorsal region. Though highly recommended by numerous syphilographers, the hypodermic use of mercury has not gained much favor with the profession at large, and it is principally employed only when mercurials are not well borne by the mouth or by inunction, or do not effect a cure. The average dose for hypodermic use is gr. $\frac{1}{16}$–$\frac{1}{12}$. *Externally* it may be used as a caustic. It is destructive to the lower forms of life, and hence may be used as an antiseptic in weak solution (1 part to 2000 parts of water, or about gr. j–f℥ivss, *vide* Antiseptics), instead of carbolic acid; a weak solution (gr. ½–j–ij to water f℥j) is much employed as a wash to *ulcers*, an injection in *gleet*, and to remove *freckles*. An ointment (gr. ½–j–ij to lard ℥j) is a good application in *porrigo*, *tinea*, *eczema*, *phthiriasis*, and skin diseases generally of parasitic origin. There is danger from the external application of corrosive sublimate to a large surface.

In *gonorrhœa* after the acute stage has passed, corrosive sublimate, gr. $\frac{1}{12}$–$\frac{1}{8}$ in water, f℥viij is an excellent injection, and according to Koch is the most effective agent with which to kill the gonococci. After the first trial the strength should be regulated just short of irritating the urethra.

As a *tineacide* in *ringworm* the strength may be gr. iij-v in an ounce of the compound tincture of benzoin, the solution to be applied every few days with a brush. The parts should first be cleansed with sapo viridis, or an alkaline lotion. The following is serviceable to destroy *pediculi:* ℞ Hydrargyri corrosivi sublimati, gr. vj ; acidi acetici diluti, fʒij ; aquæ, ad f℥iv. M. Sig.—Apply with a sponge morning and evening. The acid is added to dissolve the nidus of the lice around the base of each hair-shaft.

Hydrargyri Iodidum Viride (*Green Mercurial Iodide*) (*Mercurous Iodide*) (Hg_2I_2) is made by rubbing mercury and iodine together, with the addition of a little alcohol. It is a greenish-yellow powder, insoluble in water, alcohol and ether. By exposure to light it is partially decomposed, and becomes of a dark olive color.

EFFECTS AND USES.—This mercurial exercises a specific influence over the lymphatic and glandular systems, and is employed in *syphilis* and *scrofula*. It is a favorite with many practitioners in the treatment of the syphilides : ℞ Hydrargyri iodidi viridis, gr. iv ; morphinæ sulphatis, gr. j. M. et ft. pil. xx. One of these pills may be given one-half hour after meals, and the dose gradually increased by one pill per day until tenderness of the gums, or gastro-intestinal symptoms supervene, when the quantity must be lessened. *Externally*, it is applied in the form of ointment, to *syphilitic ulcers*, etc. Dose, gr. ¼-j.

Hydrargyri Iodidum Rubrum (*Red Mercuric Iodide*) (HgI_2) is made by mixing solutions of potassium iodide and mercuric chloride, from which a double decomposition ensues, resulting in the formation of potassium chloride in solution, while red (mercuric) iodide is precipitated. It is a scarlet red powder, which becomes yellow when heated, insoluble in water, but soluble in boiling alcohol and solutions of potassium iodide and sodium chloride. It is a powerful irritant and caustic, and is employed in the same cases as the green iodide, though much more energetic. It is useful in *syphilitic rheumatism*. In late *secondary* or in *tertiary syphilis* the following prescription is often of service : ℞ Hydrargyri iodidi rubri, gr. iij ; potassii iodidi, ʒij ; elixir aurantii, f℥iij ; aquæ destillatæ, q. s. ad ℥viij. M. et Sig. Take a teaspoonful 3 times a day.

ADMINISTRATION.—Dose, gr. $\frac{1}{16}$, gradually increased to gr. ¼, in pill or alcoholic solution ; or, still better, dissolved in a solution of potassium iodide. *Externally*, it may be used in the form of ointment (gr. xvj mixed with *ointment* ℥j), and as an antiseptic agent (q. v.)

Hydrargyri Cyanidum (*Mercuric Cyanide*). This salt is made by adding a solution of potassium ferrocyanide to sulphuric acid, by which hydrocyanic acid is produced, and this, being received in a vessel containing water and red mercuric oxide, generates water and mercuric cyanide ($Hg(CN)_2$). It is found usually in the form of permament, prismatic, white and opaque crystals, of a disagreeable styptic taste, soluble in water, less so in alcohol.

TOXICOLOGY.—It is an active poison, two fatal cases being reported by Christison,* one from gr. x, the other, gr. xxiijss.

MEDICINAL USES.—It is used as an *antisyphilitic* remedy, as a substitute for corrosive sublimate, over which it has the advantage of not producing epigastric pain, and of not being decomposed by the alkalies and organic substances. Dose, gr. $\frac{1}{16}$ to $\frac{1}{8}$.

Hydrargyrum Ammoniatum (*Ammoniated Mercury*) (NH_2HgCl). This preparation, commonly called *white precipitate*, is made by precipitating a solution of corrosive sublimate by ammonia-water; ammonium chloride is formed in solution, and ammoniated mercury is thrown down. It is considered to be mercuric ammonium chloride. It is a perfectly white powder, insoluble in water and alcohol, decomposed by boiling water, inodorous, and has an earthy, afterward metallic, taste. It is largely adulterated, chiefly with calcium sulphate.

INCOMPATIBLES.—It cannot be mixed with iodine, bromine or chlorine without composition.

TOXICOLOGY.—Its effects are poisonous. Graham† reports an instance of non-fatal poisoning in a man who, having swallowed ʒij, was seized with vomiting and bloody diarrhœa, but no salivation nor sponginess of the gums occurred.

MEDICAL USES.—It is used only as an *external* application, as a powder or in the form of *ointment* (*unguentum hydrargyri ammoniati*, 10 parts of ammoniated mercury to 90 parts of benzoinated lard), to cutaneous eruptions, as *phthiriasis*, and to destroy *pediculi* and the *tinea of ring-worm.*

Hydrargyri Subsulphas Flavus (*Yellow Mercurial Subsuphate*) ($Hg(Hgo)_2SO_4$). This salt, commonly called *turpeth mineral*, from its resemblance to the root of *Ipomœa turpethum*, is made by throwing mercuric sulphate (as obtained from the action of sulphuric and nitric acids on mercury) into *boiling water;* the mercuric sulphate is instantly decomposed into a soluble acid salt and the insoluble yellow subsulphate—*turpeth mineral*—which is precipitated. It is an inodorous, lemon-yellow powder, entirely dissipated by heat, of a rather acrid taste, and sparingly soluble in water.

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* "A Treatise on Poisons," 4th ed., p. 427. † *Brit. Med. Journ.*, 1869, p. 329.

TOXICOLOGY.—In an overdose it is poisonous,* gr. xl having proved fatal to a man, the chief symptoms being violent vomiting and purging.

EFFECTS AND USES.—It has been employed as an *alterative*, in doses of gr. ¼–½ : as an *emetic*, in *croup* it is highly recommended in doses of gr. ij–v in syrup or honey, repeated in fifteen minutes if there has not been decided vomiting, and given throughout the attack whenever the breathing becomes suffocative from accumulations of mucus. It produces free vomiting without effort or subsequent depression.

Hydrargyri Sulphidum Rubrum (*Red Mercurial Sulphide*) (*Mercuric Sulphide*) (HgS), or *cinnabar* (which is found as a *native* combination), is manufactured by subliming a mixture of one part of sublimed sulphur and five parts of mercury. It occurs in the form of heavy, brilliant, deep-red, crystalline masses, which are inodorous, tasteless, entirely volatilizable by heat, and insoluble in water and alcohol. It is *not employed internally*, but is used in the way of *fumigation*, in *venereal ulcers* of the throat and nose; ʒss may be thrown on a red-hot iron and inhaled. It is but seldom prescribed. Cinnabar is used as a paint under the name of *vermilion.*

Unguentum Hydrargyri Nitratis (*Ointment of Mercurial Nitrate*). *Mercurial Nitrate* is employed chiefly in the form of ointment. This preparation, known as *citrine ointment*, is made by dissolving 7 parts of mercury in 10 parts of nitric acid and adding the solution to a mixture of nitric acid 7 parts, with lard-oil 76 parts, previously melted at 158°, and stirring until effervescence ceases. The chemical changes which result here are not precisely known; but mercuric nitrate ($2(Hg2NO_3).H_2O$) is probably formed, with fatty acids and elaïdin. Citrine ointment has a fine yellow color and an unctous consistence; but if not very carefully made, it becomes greenish, hard and friable.

MEDICINAL USES.—It is an excellent stimulant and alterative application, much employed in *porrigo, psoriasis, impetigo, pruritus ani*, and in a wide range of ulcerated and eruptive affections, *rupia* and *acne* for example. It is best to dilute it, at first, with lard.

Liquor Hydrargyri Nitratis (*Solution of Mercurial Nitrate*) (*Mer-*

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* "Med. Jurisprudence," Taylor, 1865, p. 233.

curic Nitrate) ($Hg2NO_3$) is prepared by dissolving red mercuric oxide (40 parts) in a mixture of nitric acid (45 parts) with distilled water (15 parts). It is a dense, transparent, nearly colorless liquid (sp. gr. 2.100), of a strongly acid taste, containing about 50 per cent. of mercuric nitrate in solution with some free nitric acid, and is employed as a caustic application in *hospital gangrene*, *lupus*, *venereal* and malignant *ulcers*, and, diluted, in cutaneous affections. Diluted with 12 parts of water it forms a useful application to *mucous patches*.

Toxicology.—A teaspoonful of mercury* dissolved in strong nitric acid killed a lad aged sixteen, in two and a half hours, the symptoms being abdominal pain, purging and vomiting.

AURI ET SODII CHLORIDUM——AURIC AND SODIUM CHLORIDE.

Auric and sodium chloride is a mixture of equal parts of these salts ($AuCl_3NaCl.2H_2O$). It is an orange-colored salt, without smell but having a nauseous metallic taste. It is soluble in alcohol; more so in water.

Physiological Effects.—*Locally* it is a caustic. *Internally* it is a stimulant to the nervous system, especially to the spinal cord. It acts like the mercurials on the blood, reducing the oxidizing power of the red globules (Farquharson). It stimulates the glandular secretion and increases the secretion of urine and of perspiration. Salivation, without tendency to ulceration, sometimes succeeds its prolonged use, but it is less apt to occur after the use of this salt than after the other salts of gold.† In large doses it causes violent gastro-enteritis. It stimulates the sexual organs and is said to increase the catamenia. Large quantities induce symptoms analogous to those of poisoning by mercuric chloride. The same treatment is indicated.

Medicinal Uses.—This salt is *used* chiefly as an alterative in chronic cases of *tertiary syphilis* and in *scrofula*. It is also recommended in *nervous dyspepsia*, *duodenal catarrh*, etc. In the *chronic forms of Bright's disease*, granular and fibroid kidney, improvement sometimes follows the use of small doses of this remedy, and in *functional impotence* it is not without value. Dose, gr. $\frac{1}{30}$–$\frac{1}{10}$. It is best given in pill or wafer.

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* *London Med. Gazette*, vii, p. 339.

† *Schmid's Jahrb.*, June, 1870. Martin.

IODUM—IODINE.

Iodine (I) is an elementary, non-metallic substance, found in the vegetable, animal and mineral kingdoms of nature, as in marine plants, oysters, sponges, mineral springs, etc. It is chiefly manufactured from the residuum of *kelp* (the impure soda obtained from the incineration of sea-weeds), in which it exists as a sodium iodide, by the action of sulphuric acid and manganese dioxide.

Chemistry and Tests.—It occurs in crystalline scales, of a bluish-black color and metallic lustre, of a strong, peculiar odor and a hot, acrid taste. It is very volatile, evaporating even at common temperatures; is freely soluble in glycerin, alcohol and ether, and but very slightly soluble in water (1 part in 7000 parts of water). Its solubility in water is very much increased by the addition of certain salts, as the potassium iodide, sodium chloride, etc. When heated its vapor has a rich violet color, whence its name (from ἰώδης, violet). *Tests.*—Iodine may be detected in very minute quantity by decoction of starch, which produces with it a combination of a deep-blue color, termed "iodide of starch"; if combined, the iodine must be first freed with a little nitric acid, or still better with *chromic acid.* A solution of iodine in chloroform should be perfectly clear.

Incompatibles.—With the alkaloids, and most of the metallic salts, iodides are produced. Given in aqueous solution the iodine is precipitated; potassium iodide promotes its solubility in water.

Aids.—Carbolic acid and the mercurials.

Physiological Effects.—Iodine is an antiseptic, antizymotic and protoplasmic poison, killing the lower forms of animal and vegetable life. It acts *locally* as an irritant; when applied to the epidermis it stains it yellow, and causes itching, redness and desquamation; and when inhaled in the form of vapor, it excites irritation in the air-passages. *Internally*, in *medicinal doses*, it produces a sensation of heat and burning in the stomach, and soon irritates that organ. It is readily absorbed by the mucous membranes generally, and is found in the blood chiefly in combination with sodium; after absorption it produces a remedial alterative effect, without any obvious disturbance of the functions. In a physiological condition patients become thin under its use, though when iodine or the iodides are are administered in syphilis, their alterative action on the nutrition produces *embonpoint*, due to the elimination of the syphilitic poison which has depressed nutrition, and the consequent reaction of the system. It excites the secretions generally, increasing the flow of urine, slightly relaxing the bowels, often producing a marked irritant effect on the respiratory mucous membrane and salivary glands, and is readily and rapidly eliminated from the blood, in the urine and saliva (Sée*), and by the mucous membranes generally. If administered in too large doses, or to persons of irritable stomach, or to individuals susceptible to its action, it gives rise to subacute gastro-enteritis; and when continued for a long time it will produce gastro-enteric symptoms—headache, giddiness and other evidence of cerebro-spinal disturbance—marasmus—sometimes discoloration of the skin—or various cutaneous eruptions as acne—occasionally salivation—and frequently a *wasting of the mammæ and testicles.* This train of symptoms is termed *iodism.*

TOXICOLOGY AND ANTIDOTES.—In excessive doses it may act as an irritant poison, and has even produced death; but such a result is rare. In the case of a woman† ʒj in spirit f℥j proved fatal, the chief symptoms being violent pain in the throat and stomach. Culpeper‡ reports a fatal case of poisoning from the application of a preparation of iodine (ʒij) to the entire surface of the legs of a child aged eleven. The symptoms were vomiting, purging (dysenteric), pain in the head and stomach, hiccough, and suppression of urine. Large quantities have, however, been taken with slight effects (ʒiiss). The antidote is starch, which may be taken in the form of flour arrow-root or ordinary starch-water. The stomach should first be evacuated.

MEDICINAL USES.—Iodine has been used with success in some cases of *vomiting of pregnancy;* a few drops of the tincture may be given for this purpose. It is a most valuable *resolvent* remedy in *chronic visceral and glandular enlargements, indurations, thickening of membranes, tumors,* etc. It is employed in *goitre* and *scrofula;* also as an alterative in the late secondary and in the tertiary manifestations of *syphilis* when the iodides are not tolerated, and in other chronic affections. It is highly recommended by the Germans in the treatment of *typhoid fever,* reducing the temperature and restraining diarrhœa; the compound solution or tincture may be given, largely diluted. The administration of iodine is advised by many practitioners in *malarial fevers*, and, while it is admitted that it cannot compete with quinine in these diseases, it is said that, generally, it promptly arrests the attack.* The compound tincture should be given in doses of ♏x–xv thrice daily (Dr. Anderson, quoted by Ringer). The *vapor* given off by volatilizing the tincture by hot water in a wide-mouthed bottle has been inhaled with benefit in *chronic bronchitis*, *phthisis*, obstinate *sneezing*, and in the coryza of *hay-fever*, *influenza*, and *acute nasal catarrh*.

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* *London Med. Record,* 1873, p. 777.

† *Provincial Med. and Surg. Journ.,* 1847, p. 356.

‡ *Therap. Gaz.,* April, 1888, p. 225.

It is a valuable *topical* remedy, and is applied in the form of tincture, with the greatest advantage, to *enlarged glands* (especially when *scrofulous*), *erysipelas*, *boils*, *carbuncles*, in the forming stage of *abscess*, *adenitis*, and *bubo*, in *endometritis* applied within the uterus upon a probe armed with cotton, to prevent pitting in *smallpox*, as a counter-irritant to the chest in *phthisis*, *chronic bronchitis*, and *pleurisy* to the larynx in *acute* and *chronic laryngitis*, and *hoarseness*, and in *chronic thickenings* and *exudations*, *around the joints*, due to *rheumatism*, *synovitis* or *injuries*, and to promote the absorption of fluid in *diseases of the bursa*. Iodine topically is contraindicated when suppuration is about to take place as indicated by a hot, tense, inflamed condition of the parts. The time then has arrived for soothing emollient applications. As a counter-irritant, six coats should be applied to the part, morning and evening, with a camel's-hair pencil, and each coat allowed to become dry before the succeeding one is laid on—to be discontinued when desquamation occurs. It is more suitable to chronic than acute affections. As an *injection* in *hydrocele*, it has been used with benefit. After the evacuation of the sac, fʒss–j is introduced, and the pain may be diminished by the previous injection of ♏xx or more of a solution of cocaine (4 per cent.). Dr. S. W. Gross† has collected 540 cases of hydrocele treated with iodine in which there were no deaths, recurrence in 8.15, and suppuration or gangrene in 1.66 per cent. In *chronic pleurisy* with effusion after aspiration, it has even been injected into the pleural cavity. It is occasionally resorted to as an injection in *spina bifida*. In *cystic goitre* Dr. A. Worner, of Tübingen, recommends the injection of pure tincture of iodine after puncture and withdrawal of the fluid. It may also be used with excellent effect in *hypertrophied tonsils* and *glandular tumors.* The tincture should be deeply injected into the part, and care must be taken not to throw the injection into a vessel. Prof. Richet * highly recommends the hypodermic injection of the tincture in cases of *malignant pustule*, and Beverly Robinson,† following the treatment of Prof. William Pepper, has successfully injected from ♏v–10 of Lugol's solution, diluted with 15 parts of distilled water, into *phthisical cavities.* The injection should be made either high up in the axillary region, in the 1st, 2d, or 3d intercostal space, or anteriorly in the 1st, 2d, or 3d, intercostal space, on or to the outside of the line of the nipple. Iodine ranks also among the best of the disinfectants, being available from the ease of its application as well as its ready portability.

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* *Am. Journ. Med. Sci.*, April, 1883. Drs. Atkinson and Woods, of Baltimore. N. F. Snejkoff (*Meditz Oboz.*, Fasc. xxiii, 1884, p. 1042), obtained no effect from iodine in two-thirds of their cases of malarial fevers.

† *Med. Times*. April, 1888, p. 384.

ADMINISTRATION.—Iodine is rarely exhibited alone, but usually in conjunction with potassium iodide (q. v.). To avoid gastric irritation, it is best given after a meal, particularly when amylaceous substances have been taken, as it forms with them iodized starch. Dose, gr. ¼-½ two or three times daily. *Liquor iodi compositus—compound solution of iodine*—sometimes known as *Lugol's Solution* (iodine 5 parts, potassium iodide 10 parts, distilled water 85 parts), is the usual preparation in which iodine is administered internally, dose, ♏v-xv three times a day, in sweetened water and gradually increased. The *tincture* (*tinctura iodi*) (8 parts to alcohol 92 parts) is of a deep-brown color, and undergoes a gradual change when kept long; water precipitates the iodine from it, hence it is little employed internally; dose, gtt. x-xx, repeated and increased. *Externally* the tincture is extensively applied to *erysipelatous* and *poisoned parts*, *chilblain* and *parasitic affections,* as *tinea circinata*, *versicolor*, and *capitis.* Stains of the tincture may be removed from the skin by aqua ammoniæ; from linen by sodium hyposulphite in solution. The compound tincture (iodine ℥ss, potassium iodide ℥j, alcohol Oj is not official, but has the advantage over the tincture that it may be diluted with water without decomposition, dose, gtt. xv-xxx. *Iodine ointment* (*unguentum iodi*) (made with iodine 4 parts, potassium iodide 1 part, water 2 parts, and benzoinated lard 93 parts) is employed as a local application in *goitre*, *scrofulous tumefactions*, etc., and frequently as a substitute for the tincture. *Iodine baths* have been employed, with iodine and potassium iodide dissolved in water, in a *wooden* bath-tub, in the proportion of iodine gr. iij and potassium iodide gr. vj to a gallon of water. By this method the systemic effects of iodine are obtained.

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* *Rev. des. Sci. Méd.*, Avril 21ième, 1883.

† *N. Y. Med. Rec.*, Jan. 10th, 1885.

POTASSII IODIDUM—POTASSIUM IODIDE.

Preparation and Description.—This salt is prepared by treating an aqueous solution of potassa with iodine in slight excess. By this process a mixture of potassium iodide and potassium iodate is obtained, and the iodide is afterward deoxidized and converted into iodide by heat and mixture with powdered charcoal. Potassium iodide (KI) occurs in semi-opaque, white or transparent anhydrous crystals, permanent in a dry air, rather deliquescent in a moist one, of an acrid, saline taste, somewhat like that of common salt. It is wholly soluble in water and alcohol, and its aqueous solution dissolves iodine, forming *ioduretted potassium iodide.* It is frequently adulterated with other salts.

Incompatibles.—With acids and acid salts, spt. nitrous ether, the soluble lead salts and the mercurials generally, silver nitrate and the alkaloids; with potassium chlorate, if a mineral acid be added, a poisonous potassium iodate is produced.

Aids.—The mercurials.

Physiological Effects.—The effects of potassium iodide are *analogous* to those of iodine, but less energetic. *Locally*, it acts as an irritant. *Internally*: when given by the stomach on account of its ready diffusibility, it is soon taken up by the blood and can shortly be tasted in the saliva. In large doses it sometimes occasions nausea, vomiting, heat of stomach, and purging; but it may be given in larger doses, and for a longer period, than iodine without causing gastro-enteric derangement. Pélikan in 1856 denied that the iodides of the alkalies irritate the gastro-intestinal mucous membrane, and this has recently been affirmed by Dr. A. Smirnoff, (*loc. cit.*). Under its prolonged use, the digestive function of the gastric juice fails, although the quantity secreted remains unaltered (A. Smirnoff*). It stimulates the secretions, particularly those from mucous membranes, and very often produces coryza. During a course of iodide treatment acneiform eruptions are likely to break out. Potassium iodide decidedly lessens the secretion of milk, and as it disturbs the functions of the glands the relative quantity of the different ingredients fluctuates. Iodine appears in the milk very soon after the first dose of the salt is taken, and disappears as soon as the drug is stopped. It is found in combination with the casein of the milk, but the amount present bears no constant relation to the amount of the salt administered (Dr. Max Stumpf*). According to Trasbot potassium iodide produces acceleration of the pulse and vascular dilatation, which leads to an abundant glandular secretion. Its constitutional effects are powerfully *alterative* and *resolvent*, as it increases the disintegration and elimination of albuminous compounds, thus causing wasting and emaciation when administered in health; but like iodine, it acts most readily on morbid products. It is eliminated by the mucous membranes generally, but chiefly by the kidneys acting as a diuretic and increasing the amount of water, urea, uric, phosphoric and sulphuric acids in the urine.

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* "Inaug. Dissertation," St. Petersburg, 1884.

MEDICINAL USES.—It is employed in *goitre* and *scrofula;* in *tertiary syphilis* (in which it is usually combined with or followed by some mercurial preparation), and other chronic diseases, accompanied with *enlargements* or *exudations* as of the *joints.* It is a most valuable antisyphilitic remedy when the bones and fibrous tissues and true skin are affected, as in *caries*, *periostitis* and *rupia.* In all affections of syphilitic origin, nervous or otherwise, as *syphilitic neuralgia*, *amaurosis*, *keratitis*, or *paraplegia*, large doses of the salt give prompt relief, and in *gummata* of the brain and other parts they are of signal advantage. It has been given hypodermically when it disorders the indigestion. In *chronic rheumatism*, *gonorrhœal rheumatism*, and *gout*, particularly where the fibrous tissues are attacked, it is of great efficacy. It is highly recommended in the early stages of *interstitial hepatitis* (cirrhosis) before contraction has taken place. As a diuretic in *serous effusions* it has been found useful; and in spasmodic *asthma*, given between the attacks, it will often prevent their occurrence or increase the interval between them. As an eliminative antidote in *mercurial* and *saturnine poisoning* its action has been already noticed. It has been recommended in *hydrocephalus*, to promote absorption in the latter stage of *cerebro-spinal meningitis*, as an *alterative* in *spinal sclerosis*, and it has been found to exercise a beneficial influence in the treatment of *aneurism.* In deep-seated aneurism, large doses (gr. xx–xl) are advised by Burney Yeo† who thinks these exert a favorable influence by diminishing cardiac action and lowering the general blood-pressure. Dr. H. W. Stelwagon* recommends it highly in subacute and chronic *eczema*, especially when arsenic has failed to exert a favorable influence on the disease, combined with suitable external treatment. He gives gr. ss increased to gr. v to a child in syrup of orange-peel and water, or to an adnlt, gr. v–x in Huxham's tincture or compound tincture of gentian.

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* *Deutsches Arch. f. klin. Med.*, Jan., 1882.

† *Lancet*, Feb., 1886.

ADMINISTRATION.—Dose, gr. v–xv to ʒj or more (depending on the idiosyncrasy of the patient), three times a day, in aqueous solution, disguised with the compound syrup of sarsaparilla, simple elixir, or syrup of orange, but very much larger doses may be required in *tertiary syphilis*. Mr. Jonathan Hutchinson† recommends beginning with a small dose (gr. ij–iij) at first, increased by the addition of gr. ij per week, if the cure be not progressing rapidly. He finds a combination of ammonium, sodium and potassium iodides often answers better than the potassium salt alone, and that free ammonia or sal volatile increases the efficiency of any of the iodides. An *ointment* (potassium iodide, 12 parts, sodium hyposulphite 1 part, benzoinated lard 81 parts, boiling water 6 parts), is employed for the same purpose as iodine ointment, and does not discolor the skin; it is, however, of feebler efficacy. It is said that when administered in milk, not only is the unpleasant taste somewhat disguised, but the salt is less apt to disagree with the stomach.

Ammonii Iodidum (*Ammonium Iodide*) (NH_4I)—is made by the double decomposition of potassium iodide and ammonium sulphate in hot aqueo-alcoholic solution. It occurs as a white, granular, very deliquescent salt, becoming yellowish-brown by exposure, but when deeply colored, the U. S. P. directs that "it should not be dispensed." It is very soluble in water and alcohol, of a taste like that of potassium iodide, but a little sharper.

MEDICINAL USES.—It *has* been similarly used as the latter salt, and recommended in *catarrhal jaundice* after the acute symptoms have subsided (gr. j–iij p. r. n.), and in the early stages of *cirrhosis of the liver*. It is also very useful in *chronic bronchitis*, *capillary bronchitis* and in *pneumonia* to promote the absorption of the exudation and to prevent caseous degeneration.

Sodii Iodidum (*Sodium Iodide*) (NaI)—may be made by the double decomposition of iron iodide and sodium carbonate. It is a soluble, white, crystalline salt, used to fulfill the same indications as potassium iodide, than which it is said to be better borne.

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* *Med. News*, April 2d, 1885.

† "On Syphilis," 1887.

Medicinal Uses.—Iodine is *employed* in medicine in various chemical combinations. The *iron, lead and mercurial iodides* have been noticed. *Iodized starch* (*amylum iodidum*) has been highly recommended as a dressing for syphilitic ulcers, etc. *Zinc iodide* (see p. 205) is employed as a tonic and astringent. *Sulphur iodide* (*sulphuris iodidum*) is prepared by heating together iodine 4 parts, and washed sulphur, 1 part; it is a grayish-black solid substance, of a radiated crystalline appearance, having the smell and taste of iodine, decomposed upon exposure to the air and by boiling water and alcohol, insoluble in water, but soluble in 60 parts of glycerin; it is used *internally* in *scrofulous* and *cutaneous affections*, in doses of gr. ½-j, and *externally* in *tinea capitis*, *lupus*, *lepra*, *acne*, etc., in the form of ointment (gr. xxx to lard ℥j). The dose of sodium iodide is gr. v. to xv. to ʒ, administered in the same way as the potassium iodide.

OLEUM MORRHUÆ—COD-LIVER OIL.

This is a FIXED OIL obtained from the LIVER of Gadus Morrhua, the *common cod* (*Class* Pisces; *Ord.* Teleostia, *Fam.* Gadida)—a well-known fish of the northern Atlantic—and also from the livers of several other species of Gadus.

Preparation.—It is prepared by subjecting the livers to heat, either in boilers with water or by means of steam externally applied, and afterward draining off the liquid portion, from which the oil separates on standing. It is said to be sometimes procured also by expression. Three varieties are known, the *white* or *pale-yellow*, the *brownish-yellow*, and the *dark-brown*. They differ chiefly in the mode of preparation—the *pale* being prepared from fresh livers, the *dark-brown* from those which are collected at sea and have undergone putrefactive decomposition, and the *brownish-yellow* from those in which putrefaction has only partially commenced. The pale oil is the purest; the dark oil is the most offensive to the taste and smell, and the least acceptable to the stomach.

Chemical Constituents.—Cod-liver oil is of the consistence of lamp-oil, and has a peculiar odor, resembling that of shoe-leather—which is usually prepared in the United States with this oil—and a fishy-acrid taste. These sensible properties are probably the best tests of the oil, and it should be rejected if the smell and taste of shoe-leather are wanting, or if those of lamp-oil or fish-oil are very perceptible. The sp. gr. of the best oil is about 0.920–0.925. The oil undergoes a gradual change from exposure to the air, and should, therefore, be kept in full and well-stoppered bottles. It is insoluble in glycerin and water, somewhat so in alcohol, readily soluble in ether and chloroform. It contains a great variety of *chemical constituents*, the most important of which are *fatty acids*, several *biliary principles*, a peculiar brown substance called *gaduin* (which is not, however, supposed to be the *active* ingredient), *iodine*, *chlorine*, and traces of *bromine*.

Dr. Joseph Lefage,* assisted by Dr. Chapoteaut, obtained a product from the oil which they named *morrhuol*, and which represents the active principles of cod-liver oil.

It is obtained (1) by treating the oil with an aqueous solution of sodium bicarbonate, which dissolves the acid at low temperature; (2) by agitating the oil with 90 per cent. of alcohol, separating it from the oil and submitting it (alcohol) to distillation. Morrhuol is acrid, bitter, very aromatic and partly crystalline at ordinary temperatures. It contains considerable quantities of iodine, bromine and phosphorus. The oil after its removal is tasteless and odorless.

Tests.—Cod-liver oil may be distinguished from other oils by the agency of sulphuric acid, a drop of which, when added to fresh cod-liver oil, on a porcelain plate, causes a centrifugal movement in the oil, and gives rise to a fine violet color, soon passing into yellowish or brownish-red. This reaction is attributable, however, to the bile contained in the oil. By reaction with ammonia, in distillation, the peculiar volatile principle *trimethylamine* (the odorous principle of pickled herring) is developed.

Physiological Effects.—Cod-liver oil, like all fats, is appropriated not in the stomach, but in the small intestine where it is emulsified by the pancreatic juice and bile forming the molecular base of the chyle. Being colloidal and therefore not in a state to osmose easily its passage through the intestinal walls into the portal blood is facilitated by the bile. Its prolonged use, in doses which allow it to be retained by the digestive tube, produce very marked beneficial effects in a wide range of chronic diseases dependent on a vitiated condition of the functions of digestion, assimilation and nutrition. Its *modus medendi* is not well understood; some therapeutists believing it to act merely as a nutritive agent, valuable from the readiness with which it is assimilated; others attributing its curative powers to an alterative action from the iodine and bromine or other principles which it contains. Its effects are, however, probably due merely to its nutrient action, in supplying a sufficiency of molecular base for interstitial growth. The biliary principles which it contains promote its absorption and appropriation by the system. The most striking feature of its action on the economy is *increase of weight;* and usually, where it fails to increase the weight, it is of little service. It is believed, also, to diminish the formation of uric acid in the system, and hence may be useful in gout. In *large doses*, cod-liver oil produces nausea and diarrhœa, and these effects occasionally follow the use of medicinal doses.

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* *Der Fortschritt*, Feb. 20th, 1886, from *Le Bull. de Thérap.* and *Le Bull. Com.*

MEDICINAL USES.—Cod-liver oil has long been known as a remedy in *rheumatic* diseases; and within the last forty years it has come into extensive use as an alterative and nutrient in *tuberculous*, *scrofulous affections*, and in various *cachexiæ*. In the treatment of *phthisis pulmonalis* it is now looked upon, in Great Britain and the United States, as equal to or superior to any other agent, and as possessing an undoubted power of arresting the progress of both the general and the local symptoms of the disease. Although efficacious in all the stages of phthisis, its value is most conspicuous early in the disease, especially before the formation of true tubercles.

Over the different forms of *scrofula* it exercises also a very decided control—particularly *adenitis*, *ulcers*, *diseases of the joints and spine*, *rickets*, *ophthalmia*, and *keratitis*. In the various cutaneous affections, *tertiary syphilis*, *chronic rheumatism*, *rheumatic arthritis*, and gout, and the entire circle of chronic disorders in which there is a tendency to *marasmus*, and where the nutrition is defective, as in *hemiplegia*, *emphysema*, and *asthenia*, cod-liver oil is employed with benefit. Its good effects are most conspicuous in proportion to the youth of the patient.

Morrhuol is strongly recommended in the first stage of *tuberculosis*, in *infantile scrofulosis* and *rachitis*, and in *chronic bronchitis*.* Dr. E. Chazeaud,† from the careful study of ten cases of *pulmonary*

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* Dr. Joseph Lefage, *op. cit.*

† Ètudes cliniques sur le morrhuol, thèse, par E. Chazeaud, Paris, 1887.

phthisis in which he had administered morrhuol, concludes that it increases the appetite and weight, lessens or extinguishes the cough and with it the symptoms of debility, and diminishes the excretion of urea.

ADMINISTRATION.—Dose f℥ss two or three times a day, one hour after each meal; though, if unacceptable to the stomach, it is best to begin with f℥j doses. The addition of a little ether (gtt. xij–xx to f℥j of oil) promotes its digestion. It must be persevered with for a long time before its good effects appear. It is best given in some aromatic water, or a little ardent spirit, or the froth of porter; and it may be rendered more agreeable to the stomach by combination with one of the mineral acids. The union of the oil with lime-water, just enough to form a soap, often renders it acceptable to delicate stomachs, and it may be flavored with oil of bitter almond. If it produce diarrhœa, astringents should be administered with it, or the dose should be decreased, or the oil stopped. It is used as a *clyster* in cases of *ascarides* and *lumbricoides;* and *externally*, as a lubricant in cutaneous affections, and in *opacity of the cornea.*

Phosphorated cod-liver oil is made by the direct addition of phosphorated oil (see p. 185) to the amount of cod-liver oil required to furnish the desired strength of phosphorus.

Morrhuol is best given in capsules (gr. iij = gr. 80 of the oil) on account of its disagreeable taste and aromatic smell.

ARSENII PRÆPARATA—PREPARATIONS OF ARSENIC.

Metallic arsenic is inert, though when swallowed it may prove powerfully poisonous by becoming oxidized and converted into arsenious acid. It is not used in medicine.

Acidum Arseniosum (*Arsenious Acid*) (As_2O_3), sometimes called *white arsenic*, *arsenic oxide* or *arsenic.*

PREPARATION AND DESCRIPTION.—It is obtained principally as a secondary product in the roasting of cobalt ores (the cobalt arsenides) in Saxony and Bohemia. It is afterward purified by sublimation, and when recently prepared, occurs in glassy, colorless, transparent masses of a vitreous fracture, which gradually become white and opaque, progressively from the surface inward. It is kept sometimes in the shops in the form of a fine white powder; but in this state it is liable to adulteration with chalk or calcium sulphate, and it should, therefore, be always purchased in masses.

It is entirely volatilized by heat, at a temperature not exceeding 424.4° F.; has no smell and little or no taste; is soluble in water, and also in alcohol and oils. *Cold* water dissolves from $\frac{1}{10000}$th to $\frac{1}{500}$th part of its weight of arsenious acid, or about gr. ss–j to f℥j. By prolonged boiling with water $\frac{1}{40}$th part will be dissolved and retained in solution, or about gr. xij to f℥j.*

TESTS.—Owing to the frequent use of arsenious acid as a poison, a knowledge of the means of detecting its presence is of great importance. In the *solid* state it may be recognized in the first place by its *volatility* (heated over a spirit-lamp, it passes off as a white, inodorous vapor, and is deposited on a cool surface as an amorphous powder or in octahedral crystals): secondly, when thrown on burning charcoal it is deoxidized, and gives out the *garlicky odor* of metallic arsenic (other substances give off a similar odor); and thirdly, if heated in a glass-tube with charcoal or black flux, it sublimes and condenses in the form of a brilliant steel-gray ring or mirror, soluble in sodium or calcium hypochlorite. In *aqueous solution* arsenious acid may be detected by the following reagents: *sulphuretted hydrogen* or *ammonium sulphide* produce a *lemon* or *sulphur-yellow* arsenic trisulphide, which may be distinguished from the antimonial and stannic sulphides by being soluble in a solution of ammonium carbonate and insoluble in diluted hydrochloric acid; the addition first of *ammonia* and then of *silver nitrate* produces a *canary-yellow* silver arsenite; and the addition of *ammonia* and then of *cupric sulphate* produces an *apple* or *grass-green* cupric arsenite; gr. 100 boiled with diluted hydrochloric acid, and then treated with sulphuretted hydrogen, yield, a deposit of arsenic trisulphide weighing gr. 124. The arsenic trisulphide may be *reduced* and made to yield metallic arsenic, if heated with soda flux or potash flux.

A very delicate test for arsenious acid in solution is that of *nascent hydrogen* termed *Marsh's test.* When the acid is submitted to the action of nascent hydrogen (evolved by the action of diluted sulphuric acid on pure zinc), it is deoxidized, and unites with the hydrogen to form arseniuretted hydrogen gas. This gas has a garlicky odor, and is recognized by its burning with a bluish-white flame which deposits on a plate of cold glass or porcelain, held over the jet, a lustrous steel-gray or brownish black spot or mirror of metallic arsenic, surrounded by a faint white ring of arsenious acid; the metallic spot deposited is distinguishable from antimony, obtained by a similar process, by the addition of a drop or two of fuming nitric acid, with heat, which dissolves both metals, the solutions yielding on evaporation white residues, but the arsenical residue, touched with a drop of strong solution of silver nitrate, assumes a brick-red color, while the antimonial residue remains unchanged; and also the arsenic can be dissolved by a solution of sodium or calcium hypochlorite, which does not affect antimony.

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* "Med. Jurisprudence and Toxicology," 1884, p. 239, Reese; also Taylor's "Med. Jurisprudence," 7th Am. ed., p. 140.

Another test is that of *Reinsch*, which consists in boiling a solution of the acid with hydrochloric acid and copper-foil or wire, when the latter acquires a steel-gray coating of metallic arsenic, passing, as it increases, into black. Other metals, as mercury and antimony, are deposited on copper under similar treatment, so that additional tests will have to be made to prove their absence.

The *Berzelius-Marsh* test consists in the decomposition of arseniuretted hydrogen gas in the reduction tube (of a Marsh-apparatus) by heat, with the production of a metallic deposit before the flame is reached. It is now considered to be the most delicate of all the tests.

When arsenious acid is dissolved with liquid organic substances, it should first be separated from insoluble matters by filtration, and the metallic arsenic may be then obtained by *Reinsch's process*, and the liquid or subliming tests afterward applied. If the poison be mixed with *solid organic substances*, they should be cut up and boiled with water acidulated with hydrochloric acid, and the solution afterward filtered and again boiled, etc.

INCOMPATIBLES.—With the salts of silver, copper, ammonia, lime-water, iron and the vegetable astringents.

AIDS.—Quinine, iron, nux vomica.

PHYSIOLOGICAL EFFECTS.—Arsenious acid acts *locally* as an escharotic by destroying the vitality of the parts to which it is applied. In *medicinal* doses it stimulates the digestive and nutritive functions, as is shown by the well-known results of arsenic-eating among the peasantry of Austria. Ringer and Murrell's* experiments upon frogs show that arsenic is poisonous to all nitrogenous tissues, but that it takes some time for it to destroy the conductivity of the motor-nerves and the muscular irritability. Their experiments differ from those of Sklarek* in respect to sensation and reflex action, for they found that the afferent nerves retained their conductive power, while Sklarek states that sensation and reflex action are abolished in ten minutes. The paralysis finally produced by arsenic is centric, with which statement all observers agree.

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* *Journ. of Physiol.*, 1878–9, p. 213.

The physiological effects of arsenic are not, at first, very obvious. When continued for some time, it usually produces more or less heat and dryness of the throat and stomach, with nausea, increased secretion from the bowels and kidneys, irritation of the conjunctival and nasal mucous membranes, and a peculiar swelling of the face termed *œdema arsenicalis;* after the latter symptom appears, the medicine should be suspended. No matter how administered, or by what channel it enters the system, arsenic shows a marked selective affinity for the gastro-intestinal and mucous tracts. The absorption † of arsenious acid into the system, after its administration, is shown by its presence in the blood, viscera, bile, urine, sweat, the buccal, bronchial and intestinal mucous membranes, and after the ingestion of large doses, a considerable amount is found in the liver (Lolliot ‡). According to Rabuteau §, arsenic diminishes the excretion of urea, but other observers have not confirmed this statement.

Recently arsenic has been found to be deposited in the nervous system: thus, if in fresh muscle 1 part is found, the proportion in liver is 10.8; in brain, 36.5; in the spinal cord, 37.3 (Scolosuboff ||). Injected into the blood in mammals it causes an enormous sinking of the blood-pressure with slowing of the pulse rate (Unterberger ¶).

Small doses of arsenic increase the cardiac action and the activity of the capillary circulation; large doses cause palpitation, a small, quick and irregular pulse, with flushed face and cold extremities; poisonous doses depress the circulation and (in the lower animals) paralyze the heart in diastole. Arsenic, if too long continued or given in an excessive dose, decreases the number of globules in the blood, decomposes the hemoglobin and renders it less

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* *Arch. für Anat. u. Physiol.*, 1866, p. 481.

† *Arch. Gén. de Méd.*, t. IV, 6ième ser., p. 173; Bergeon et Lemaitre.

‡ *Bull. Gén. de Thérap.*, LXXV, p. 358.

§ *Gaz. Hebdom.*, V, p. 705.

|| "Compte Rendus des Séances," II, 6ième ser., p. 304.

¶ *Arch. für exper. Pathol. u. Pharmakol.*, II, p. 89.

coagulable (Brodie, quoted by Phillips). Small doses stimulate, while larger doses depress, both the respiratory centre and the pulmonary end-organs of the pneumogastric. At first the urine is increased, but if the drug be continued it is diminished, and may be bloody or albuminous (Kossel[*]). In *too long-continued* or *too large medicinal doses,* arsenious acid sometimes produces a kind of chronic poisoning, characterized by disorders of the digestive apparatus, conjunctivitis, œdema of the face, but more especially of the eyelids, salivation, a cutaneous eruption, pigmentation[†], loss of the hair and nails, paralysis, convulsions, and, if its use be persevered in, coma and delirium may result, terminating in death.

P. J. Hutchinson maintains that he has seen cutaneous cancer produced by arsenic. A temporary bronzing of the skin has been noticed in some cases.

It is rapidly eliminated by the urine, and also by the bile, and even the skin, tears and saliva. The milk of nursing women to whom it has been administered also contains arsenic (Brouardel, Pouchet). After it has ceased to appear in the excretions the administration of potassium iodide will cause it to reappear, showing that a part of it remains deposited in the tissues.

TOXICOLOGY.—In *excessive doses* arsenious acid is a violent poison, usually destroying life by gastro-enteritis, in from one to two or three days. Three fatal cases of arsenical poisoning have, however, been recently reported, in which no gastro-intestinal inflammation was found (J. Stewart[‡]). When very large quantities are taken, it sometimes acts on the cerebro-spinal system, producing death by narcotism in a few hours. Occasionally both gastro-enteric and cerebro-spinal symptoms occur. Pain and diarrhœa are not infrequently absent, as in the cases reported by Taylor (*loc. cit.*).

Two grains of arsenious acid have proved fatal, though much larger amounts have been taken with impunity, as in the case of a woman[§] who swallowed ʒij, and who recovered after being vomited with tartarized antimony. Very large quantities often cause emesis, which removes the poison from the stomach. M. Brouardel[||] records a case of death of a nursing infant, following symptoms of arsenical poisoning in its wet nurse, who, however, recovered. He considers it dangerous to administer arsenic to wet nurses, as the lacteal secretion is active in eliminating it.

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[*] *Arch. für. exper. Pathol. u. Pharmak.*, 1878–9, p. 213.

[†] *N. Y. Med. Record,* April 12, 1890, Wehlau.

[‡] *Med. News*, March 17th, 1888, p. 304.

[§] *Guy's Hosp. Rep.*, 1851, p. 203; Taylor.

[||] "Société de Méd. Légale," 1885.

Dissections in cases of poisoning from arsenic reveal redness (sometimes accompanied with extravasations of blood), ulceration, softening, effusion of lymph, and even gangrene, in the alimentary canal. Congestions of the broncho-pulmonary mucous membrane and of the lungs themselves are often observed, and acute fatty degeneration of the liver, spleen, kidneys, etc., is often seen, even when the poisoning has existed for a few hours only. The blood is often fluid and dark-colored. It has been shown experimentally that arsenic in solution injected into the mouth, rectum or vagina after death will diffuse itself through the body and may be found in the liver, lungs, kidneys, and even in the brain—a point of great importance in legal medicine.*

ANTIDOTES AND TREATMENT IN CASES OF POISONING.—The evacuation of the contents of the stomach by emetics or by the stomach-pump, if seen very soon after swallowing the poison, should be the first object in these cases. Demulcent drinks are to be also freely given. The FERRIC HYDRATE (*Ferri Oxidum Hydratum*) should be administered, as soon as it can be procured, in the state of *pulp or magma.* It is prepared by the action of an alkaline solution on a ferric salt. Ammonia water is directed by the U. S. P. to be added to the *solution of ferric iron* (see p. 167). The ferric hydrate is a soft, moist, reddish-brown magma, which acts as an *antidote* to arsenious acid by forming with it an insoluble, inert ferrous arseniate (Fe_2AsO_4). The dose is about twelve times the supposed amount of poison taken, and it should be given in the *fresh* and *pulpy* state, as it gradually loses its antidotal virtues when kept. The FERRIC HYDRATE WITH MAGNESIA (*Ferri Oxidum Hydratum cum Magnesia*) is also directed to be kept in the shops as an antidote to arsenic. It should be administered in the same manner as ferric hydrate, and possesses the advantage of a tendency to act on the bowels.

Dialyzed Iron is also an antidote to arsenic in the stomach. To insure its conversion into ferric hydrate, its ingestion should be followed by the administration of a tablespoonful of sodium chloride. *Light magnesia* (which has not been too strongly calcined) and freshly-precipitated *gelatinous magnesia* may be also used as antidotes. The after-treatment consists in the use of demulcents, opiates, and, if necessary, stimulants.

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* *Journ. Amer. Med. Associat.*, Aug. 4th, 1883.

Medicinal Uses.—Arsenious acid is a very valuable alterative remedy, but it must be exhibited with caution. It is employed with the greatest success in the treatment of chronic *malarial affections*, as dumb-ague, especially such cases as have resisted the use of cinchona, or have frequently re-appeared. For this purpose it should be given in the dose of gr. $\frac{1}{16}$–$\frac{1}{12}$ in pill thrice daily, after meals, and the quantity gradually pushed until some evidence of its effects is obtained. When the point of toleration is reached, the size of the dose can be regulated so that the medicine may be safely taken for a considerable period.

In *chronic cutaneous affections*, particularly the scaly diseases, *lepra*, *eczema squamosum*, *psoriasis* and *phthiriasis*, it is highly useful, but it should not be given while any *acute inflammatory* symptoms are present, or where there is much itching, burning, or heat of skin, as under these circumstances it is apt to increase the affection. *Pemphigus* is often benefited and sometimes cured by the judicious administration of the arsenical preparations, as are also certain cases of *acne*, especially when occurring on the face and characterized by numerous, finely papular lesions. A course of arsenic, too, is indicated in the *herpes* that attacks the oral cavity in the form of cankers. It is also frequently beneficial in *chronic eczema* and *lichen*. As arsenic exerts its influence on the rete mucosum particularly, it is more efficacious when the superficial layers of the skin only are involved.

It is prescribed also in *certain affections of the nervous system*, *chorea* in particular, over which it exercises a marked control; in *neuralgia* it is often of great value, especially when combined with iron and quinine; in *angina pectoris* during the attack, Fowler's solution, ♏v-x, after meals, t. d., is often serviceable; in *chronic rheumatism*, *rheumatic arthritis*, in *irritable dyspepsia*, *gastric ulcer*, *chronic diarrhœa*, *bronchitis*, *phthisis* (where there is not much hectic, nor rapid disintegration of tissue), and as a *tonic* generally, especially when *anemia* is present, it is often combined with iron and quinine: ℞ Acidi arseniosi, gr. j; quininæ sulphatis, gr. xxiv; ferri sulphatis exsiccati, gr. xij; oleo-resinæ capsici, gr. iv. M. et ft. pil. xxiv. Sig.—One pill may be taken immediately after meals three times a day.

As an *external application*, arsenious acid has been applied to *indolent sinuses*, *lupus*, *onychia maligna*, etc., either pure or mixed with several parts of sulphur; when thus used, it should be applied freely, as a large amount is more likely to render absorption impossible, by the rapid destruction of the tissues which it causes. A minute crystal of arsenic moistened with creasote on cotton will deaden the pain in the cavity of a *carious tooth.* It is an ingredient of various empirical compounds employed in the treatment of *cancer.*

Administration.—Dose, gr. $\frac{1}{16}$—$\frac{1}{12}$, in pills with extract of gentian t. d., to be reduced when conjunctivitis appears, and suspended after the establishment of the *œdema arsenicalis;* and after being taken a fortnight, it should always be intermitted for a day or two. It is less apt to occasion gastric irritability when given immediately after a meal. The usual and safer form of exhibiting this remedy is that of solution with potash. Gelatin-coated pills of arsenious acid may be had in the shops.

Liquor Potassii Arsenitis (*Solution of Potassium Arsenite*) (HK_2AsO_3), or *Fowler's Solation.* This is prepared by boiling 1 part of arsenious acid and potassium bicarbonate, each, in 10 parts of distilled water, and when dissolved, adding 3 parts of compound spirit of lavender, and water enough to make the solution weigh 100 parts; allow the solution to stand for eight days and then filter. It is a transparent liquid, of an alkaline reaction, and has the color, taste and smell of spirit of lavender.

Incompatibles.—It is decomposed by the reagents which act upon arsenic, and is incompatible with infusions and decoctions of cinchona.

Medicinal Uses.—Its *effects and uses* are analogous to those of arsenious acid, though some practitioners have denied their therapeutic identity. The *treatment in acute poisoning* is the same as that for arsenious acid.

Fowler's solution is administered *internally* in the same diseases in which arsenious acid is given. When arsenic is to be prescribed for a long time, the acid itself should be selected, but when used for a short period, or to produce a constitutional impression rapidly, the more soluble arsenical preparations are preferred (Fowler's solution, sodium arseniate, or its solution, etc.). The solution of potassium arsenite is the most available form of arsenic for administration in the various forms of *chronic skin diseases* which have already been alluded to, and may be advantageously combined with the bitter wine of iron, which will often prevent the gastro-intestinal derangement which is otherwise likely to ensue. The average dose in these cases is ♏ij-iv, t. d., prescribed with food or directly afterward, always carefully watching and guarding against the supervention of toxic symptoms.

It is a good tonic, also, in *anemia*, and in *chlorosis* especially, when the subject is a young girl just arriving at the age of puberty, where iron disorders the digestion, or where the early stage of tuberculosis is suspected. It is well to administer it for a week or more continuously, and to alternate with a less soluble form of arsenic.

In *irritative dyspepsia*, ♏j–ij well diluted, before meals, is of great value. In *gastric ulcer** the same treatment is recommended, combined with a milk diet and regulation of the bowels. It appears to lessen the amount of sugar in the urine in *diabetes mellitus*, and it has been used internally and hypodermically with varying results in the treatment of *relapsing fever*. A course of Fowler's Solution in such chronic affections as *spinal sclerosis*, *hypochondriasis*, *lymphadenoma*, and *melancholia*, when other means have failed or as an adjuvant to them, may prove beneficial. As a tonic it is well combined with syrup of calcium lacto-phosphate.

ADMINISTRATION.—Dose, ♏j-x, t. d., administered in aqueous solution. Each fluid-drachm contains of arsenious acid, gr. $\frac{6}{10}$. It may be prescribed with tonics as tincture of nux vomica.

Sodii Arsenias (*Sodium Arseniate*) ($Na_2HAsO_4.7H_2O$), is made by melting together arsenious acid, sodium nitrate and sodium carbonate, then dissolving the fused salt in boiling water, and afterward crystallizing. In this process the arsenious acid is oxidized into arsenic acid by the nitric acid of the sodium nitrate, and then combines with the soda of both salts to form colorless, transparent, prismatic crystals, slightly efflorescent; very soluble in water, of a somewhat saline, slightly acrimonious taste.

MEDICINAL USES.—This salt is employed to fulfill the therapeutic indications of the other arsenical preparations, and has the advantage of a somewhat milder local action. Dose, gr. $\frac{1}{12}$–$\frac{1}{3}$, in pill or disguised in water. It is prescribed sometimes *externally* in the form of baths, in *chronic arthritic rheumatism* and *gout*, ʒss–iij in each bath. It is generally used *internally* in the form of—

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* *Brit. Med. Jour.*, 1884, p. 1203, Strahan.

Liquor Sodii Arseniatis (*Solution of Sodium Arseniate*), made by dissolving 1 part of sodium arseniate (rendered anhydrous at a heat not exceeding 300°) in 99 parts of distilled water; dose, gtt. x–xx, mixed with water. Cigarettes made of paper saturated with a solution, two or three times the official strength, are smoked in *asthma.*

Liquor Acidi Arseniosi (*Solution of Arsenious Acid*) (formerly called *solution of arsenic chloride*) is made by boiling 1 part of arsenious acid with 2 parts of hydrochloric acid and 25 parts of distilled water, until the acid is dissolved, and adding to the solution, when cold, water enough to make it weigh 100 parts. Dose, the same as that of Fowler's Solution (q. v.), than which it is thought to be less apt to disturb the stomach.

Arsenii Iodidum (*Arsenic Iodide*) (AsI_3), made by rubbing 5 parts of iodine and 1 part of arsenic together, is an orange-red crystalline, volatilizable solid, wholly soluble in water, and has been used both *internally* and *externally* in skin-diseases. Dose, gr. $\frac{1}{8}$ t. d., in pill or disguised in water; for *external* use, gr. iij to lard ℥j.

Liquor Arsenii et Hydrargyri Iodidi (*Solution of Arsenic and Mercuric Iodide*). This solution, known as *Donovan's Solution*, is prepared by dissolving 1 part of arsenic iodide and mercuric iodide, each, in enough distilled water to make the solution weigh 100 parts. It is merely an aqueous solution of the two iodides (AsI_3 and HgI_2). It has a pale-yellow color and a slightly styptic taste.

INCOMPATIBLES.—It is incompatible with the salts of the alkaloids and the alkalies.

EFFECTS AND USES.—This is a highly valuable alterative preparation in the various forms of papular and scaly cutaneous affections, as *psoriasis* and *phthiriasis* and in obstinate *syphilis.* It was introduced by Mr. Donovan, of Dublin, in 1839, and has been a good deal employed in the United States. Dose, gtt. v to xx or more, t. d., given disguised in water.

CALCII PHOSPHAS PRÆCIPITATUS—PRECIPITATED CALCIUM PHOSPHATE.

PREPARATION.—This salt is made by reacting upon bone-ash with hydrochloric acid, which dissolves the calcium phosphate in the bones, and gives it up again on the addition of water of ammonia. It is a white, inodorous, tasteless, insoluble powder, sometimes called the *bone phosphate of calcium* ($Ca_3 2PO_4$).

EFFECTS AND USES.—It is an important and valuable medicine, not only in diseases of deficient ossification, as *ununited fractures,* *caries of the bones*, *rickets*, etc., but in all conditions of defective cell-growth and malnutrition, from its undoubted influence in promoting natural cell-growth and nutrition. Thus it is employed (often in connection with other phosphates, as those of iron, sodium and potassium) in *scrofula*, *phthisis*, *anemia*, *diarrhœa*, *chronic bronchitis*, *abscesses*, *prolonged suppurations*, and wasting diseases of every kind. On account of its insolubility it is apt to form intestinal concretions.

Administration.—Dose, gr. v–x, given dusted into a little milk. A better (because more soluble) preparation is the *syrup of calcium lacto-phosphate* (*syrupus calcii lacto-phosphatis*), containing lactic acid, calcium phosphate, orange-flower water, sugar, hydrochloric acid, ammonia water and water. An emulsion containing 50 per cent. of cod-liver oil with syrup of the lacto-phosphate is an excellent preparation. Dose, fʒj–iv.

CALCII HYPOPHOSPHIS—CALCIUM HYPOPHOSPHITE.

Preparation.—This salt is prepared by boiling phosphorus in a mixture of calcium hydrate in boiling water; phosphoretted hydrogen escapes, and calcium phosphate and hypophosphite are formed in the liquid, from which the insoluble phosphate and residuary lime are separated by filtration, and the hypophosphite ($CaH_4 2PO_2$) is afterward crystallized out in the form of white, pearly crystals, of a nauseous, bitter taste, soluble in six parts of water, and insoluble in strong alcohol.

Incompatibles.—All the soluble phosphates and carbonates produce precipitates with calcium hypophosphite. The potassium and sodium hypophosphites are incompatible with the soluble salts of mercury and silver.

Potassii Hypophosphis (*Potassium Hypophosphite*) (KH_2PO_2)—is prepared by mixing solutions of hypophosphite and potassium carbonate. It occurs in white, opaque, confused crystalline masses, having a disagreeble, bitter taste, very deliquescent and very soluble in water and alcohol, but insoluble in ether.

Sodii Hypophosphis (*Sodium Hypophosphite*) ($NaH_2PO_2.H_2O$)—is prepared by mixing solutions of calcium hypophosphite and crystallized sodium carbonate, and crystallizes in white tables of a pearly lustre, very deliquescent (but less so than potassium hypophosphite), very soluble in water and alcohol, and insoluble in ether.

MEDICINAL USES.—*The hypophosphites* have been introduced in the treatment of *phthisis* under an impression that they prove useful by furnishing phosphorus to the tissues. They more probably act by stimulating cell-growth and nutrition, and may be given to fulfill the same indications as the precipitated calcium phosphate.

ADMINISTRATION.—Dose, gr. x–xxx t. d. The calcium hypophosphite is the most eligible salt, but they are often prescribed together in the form of—

Syrupus Hypophosphitum (*Syrup of Hypophosphites*) consisting of calcium hypophosphite 35 parts, sodium and potassium hypophosphites each 12 parts, dissolved in water by the aid of citric acid 1 part, and flavored with spirit of lemon, 2 parts, of sugar 500 parts; the whole to weigh 1000 parts. It is a good preparation to fulfill the indications of the hypophosphites. Dose, f℥j–ij.

Syrupus Hypophosphitum cum Ferro (*Syrup of Hypophosphites with Iron*) contains ferrous lactate 1 part, dissolved in syrup of hypophosphites, 99 parts. It is used for the same purposes and in the same doses as the last preparation. *Ferric hypophosphites* have been noticed with *chalybeates* (see p. 172).

CALCII CHLORIDUM—CALCIUM CHLORIDE.

PREPARATION.—This salt ($CaCl_2$) is prepared by neutralizing hydrochloric acid with chalk or white marble, and adding a little chlorinated lime and slacked lime. It is a colorless, translucent salt, very deliquescent, readily soluble in both water and alcohol. It should not be confounded with chlorinated lime, which is also sometimes called "chloride of calcium."

INCOMPATIBLES.—Dilute H_2SO_4 ammonium carbonate, sodium phosphate and argentic solutions.

MEDICINAL USES.—It *resembles* the calcium preparations generally in its *effects*, and is a very efficient remedy in all *scrofulous* affections of children, as glandular enlargements, accompanied by colliquative diarrhœa, a coated tongue and fetid breath (Coghill*). Milk is a good vehicle in which to give it. It is also given with benefit in wasting diseases generally and in *phthisis*. Dose, gr. v–xx.

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* *The Practitioner*, XIX, p. 247.

AMMONII CHLORIDUM—AMMONIUM CHLORIDE.

PREPARATION AND DESCRIPTION.—This salt, formerly termed ammonia muriate, and often known as *sal ammoniac*, is obtained from the *gas-liquor* of coal-gas works (usually by neutralizing the ammonia with hydrochloric acid), and also in the preparation of animal charcoal from bones. It is brought in the *crude* state from Calcutta, for use in the arts, and in the *refined* state, for medicinal employment, from England. It occurs in white, translucent, tough, fibrous, hemispherical, convex-concave cakes (NH_4Cl), about two inches thick, difficult to powder, inodorous, of a pungent, saline taste, slightly deliquescent, very soluble in water, and less so in alcohol.

For medicinal use it is purified by the addition of water of ammonia to a solution of chloride, and occurs as a snow-white crystalline powder, soluble in 2½ parts of cold and in its own weight of boiling water, and soluble also in alcohol.

INCOMPATIBLES.—Solutions of caustic potash, soda or lime-water decompose the chloride (NH_3) being given off; tartaric acid forms with it a tartrate. The mineral acids disengage HCl; with the soluble lead and silver salts chlorides are formed.

AIDS.—As an expectorant, ipecacuanha, squill, and senega.

PHYSIOLOGICAL EFFECTS.—The physiological effects of the ammonium salts have been considered under the head of *Ammonia Preparations* (*vide* p. 220). The *local* action of ammonium chloride is that of an irritant. In large doses it purges. In small doses, after absorption, it proves a powerful resolvent-alterative, diminishing the solid constituents of the blood, with an increased flow of the secretions generally; it has an especial action upon the mucous membranes, promoting nutritive changes and epithelial exfoliation. Under its use the solids of the urine are increased, except uric acid, which is slightly diminished. Even in very large amounts it is not considered poisonous.

MEDICINAL USES.—It is not much *employed* either in Great Britain or the United States, but is extensively used in Germany as a refrigerant in mild *fevers* attended with stoppage of the secretions; as a resolvent in organic enlargements; and in *amenorrhœa*. It is used in *acute bronchitis* and *pneumonia* as an expectorant, combined with fluid extract of glycyrrhiza (which somewhat disguises its unpleasant taste) and with other expectorants: ℞ Ammonii chloridi, ʒij; extracti glycyrrhizæ fluidi, fʒj; syrupûs ipecacuanhæ, f℥iv; syrupûs pruni virginianæ, f℥iij; syrupûs tolutani, q. s. f℥vj. M. et Sig.—A dessertspoonful every three or four hours in acute bronchitis when expectoration is beginning to be established. Of late this salt has been used with advantage in *muscular rheumatism* and in *neuralgia;* and its resolvent powers are highly spoken of in *uterine fibroids.* Dr. Peters* advocates its use in large doses combined with Huxham's tincture in *rheumatic affections of the joints.* In albuminoid or *waxy infiltration of the liver* it is of undoubted avail in doses of gr. x–xx t. d.

In the early stages of *cirrhosis of the liver* it is of value, and it has been highly recommended in *torpidity of the liver, chronic hepatitis,* etc., but according to the experiments of Rutherford and Vignal, it does not increase the secretion of bile, although they found it stimulated the intestinal glands.

ADMINISTRATION.—Dose, gr. v–xxx every two or three hours, in aqueous solution disguised with simple elixir, or syrup of orange. *Externally* it is used in solution (immediately upon being dissolved) as a refrigerant lotion (℥j to water Oss), in cutaneous afffections and indolent ulcers (℥j to water Oss). *Troches of ammonium chloride* each contain ammonium chloride gr. ij with sugar, tragacanth, and syrup of tolu.

AMMONII PHOSPHAS—AMMONIUM PHOSPHATE.

PREPARATION AND DESCRIPTION.—It is made by adding stronger water of ammonia to diluted phosphoric acid, evaporating and crystallizing ($[NH_4]_2HPO_4$). It occurs in transparent, colorless crystals, having the form of six-sided tables, of an alkaline, somewhat saline taste, soluble in water, and insoluble in alcohol. As usually found in the shops, it is a mixture of the neutral and of the acid ammonium phosphate.

INCOMPATIBLES.—Same as for ammonium chloride.

EFFECTS AND USES.—This salt enjoys considerable reputation as an alterative. It has been used in this country as a remedy in *gout* and *chronic rheumatism.* In combination with ammonium carbonate and aromatic spirit of ammonia, it has also been given with advantage in *diabetes mellitus.*

ADMINISTRATION.—Dose, gr. x–xl three or four times a day, dissolved in an aromatic water.

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* *N. Y. Med. Rec.,* Jan. 23d, 1886.

POTASSII CHLORAS—POTASSIUM CHLORATE.

Preparation, Description and Tests.—This salt is prepared by various processes: a good one is by reaction upon solution of caustic potassa, mixed with lime, with a stream of chlorine; the chlorine is converted into chloric acid by oxygen from the lime, and the acid combines with the potassium to form potassium chlorate ($KClO_3$). It is a white, anhydrous salt, crystallizing in rhomboidal plates of a pearly lustre, and is inodorous, and of a cool, saline taste. It is but little changed by exposure to the air; it is soluble in 16 parts of cold water or 2 parts of boiling water. It is said to be soluble in all the animal fluids without decomposing them or undergoing change itself. *Tests*—When a few drops of H_2SO_4 are added to $KClO_3$ an explosive gas resembling chlorine is evolved. Potassium chlorate heated in a test tube yields oxygen.

Incompatibles.—It should not be prescribed in powder with the metallic sulphides, sulphur, glycerin, the vegetable powders, as tannin and catechu, as when triturated with these substances it parts with some of its oxygen to form explosive compounds.

Physiological Effects.— In its effects potassium chlorate resembles the other potassium salts (see p. 253), especially the nitrate. Introduced by the stomach, it is rapidly absorbed unaltered (Isambert[*]). When taken internally for some time, it gives a bright, arterial tinge to the venous blood, and reduces the volume and frequency of the pulse. It does not diminish the excretion of the urea, but largely increases the secretion of urine, by which it rapidly passes out of the system unchanged, as well as by the saliva (Rabuteau[†]). It has been pointed out by Dr. Jacobi that when given for some time this salt produces irritation of the kidneys and finally chronic tubal nephritis. The appetite is improved under its use, and salivation is an occasional result.

Toxicology and Antidotes.—Large doses may be taken with impunity, but excessive quantities have produced fatal gastro-enteric inflammation. In the case of Dr. Fountain,[‡] who died from swallowing ℥j, taken to prove its inertness, violent gastro-enteritis set in, and at the end suppression of urine, with death in seven days.

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[*] "Études clin., physiol., et chim. sur l'emp. thérap. du chlorate de potassa." 1856, Paris.

[†] *Gaz. Hebdom.*, v, 1868, p. 705.

[‡] *Am. Med. Times*, 1861, p. 245.

Fatal cases of poisoning from this salt have been reported, apparently from blood-poisoning, the heart and large vessels having been found filled with coagula. In cases of poisoning the stomach should be emptied and then demulcents as starch-water or arrowroot administered.

Medicinal Uses.—As it contains a large amount of oxygen, it was at first employed with a view to its oxidizing influence in contaminated conditions of the blood, as in malignant fevers, etc., but as it ordinarily does not part with oxygen except when exposed to a very high temperature, (671° F.), this view of its action is now obsolete. It is still considered a valuable alterative in *typhus*, *scarlatina*, etc., by many practitioners. Probably its most positive remedial effects are seen in various forms of *stomatitis*, follicular, mercurial, and gangrenous. It is used also in *diphtheria*, *croup*, and even *neuralgia*. *Externally*, in solution, it is an admirable wash or gargle in *stomatitis*, *tonsillitis*, *hoarseness*, *ozæna*, the sore throat of *scarlatina*, *acute* and *chronic pharyngitis*, *diphtheria*, and fetid, ulcerated surfaces generally; mixed with sugar, the powder is an excellent application in the *aphthous sore mouth* of children.

Administration.—Dose, *internally*, gr. v–xxx three or four times a day in water with some pleasant vehicle, as syrup of orange. *Troches of potassium chlorate* (*trochisci potassii chloratis*) are made by rubbing together potassium chlorate, sugar, tragacanth, spirit of lemon, and with water forming a mass; each troche contains 5 grains of potassium chlorate—serviceable in *pharyngeal cough* and *hoarseness*. For *external* use, ʒij–iv may be dissolved in water, Oss.

Sodii Chloras (*Sodium Chlorate*) ($NaClO_3$). This salt may be made in the same way as potassium chlorate, substituting a solution of soda for that of potassa. It occurs as colorless, transparent tetrahedrons, permanent in dry air, odorless, with a cooling, saline taste, readily soluble in water, soluble also in alcohol.

Incompatibles.—Same as for potassium chlorate.

Medicinal Uses.—In effects and uses it is *similar* to potassium chlorate, but milder in its action. It is not much used internally. Dose, gr. v–xx.

POTASSII BICHROMAS—POTASSIUM BICHROMATE.

The chief ore from which salts containing chronium are obtained is chrome ironstone, found in Sweden and south-eastern Pennsylvania.

Preparation and Description.—By roasting the powdered ore with potassium carbonate and nitre, the (yellow) potassium chromate is obtained, and by acidulating a solution of this with sulphuric acid, the (red) bichromate is formed ($K_2Cr_2O_7$); it separates in orange-red, anhydrous, tabular crystals, soluble in water, insoluble in alcohol, and of a cooling, bitter taste.

Incompatibles.—Soluble salts of mercury, silver, lead, liquor potassæ, sodæ and ammonia water, form new compounds with this agent and may be used as *tests*.

Toxicology.—Two drachms have caused death,[*] while a youth[†] recovered after taking ʒij, though it produced severe gastro-enteric inflammation.

Lafleur and Ruttan[‡] report the death of an adult male after the ingestion of ʒij. There was intense cyanosis of the surface, the liver and kidneys being purple, the œsophagus stained yellow, and the blood of a brown color. The interesting discovery was made that the hemoglobin was found changed to methemoglobin, which may account for the quickly fatal results of this drug.

Effects and Uses.—It is an *irritant caustic*, acting in overdoses as a corrosive poison for which the proper antidotes are magnesia, soap and the alkaline carbonates. In small doses it is alterative. In large amounts it is emetic.

Administration.—*Externally* it is a good application, in powder or in saturated solution, to *warts*, *chancroids*, etc. Dose, as an *alterative*, gr. $\frac{1}{5}$ daily, in pill with some bitter extract; as an *emetic*, gr. $\frac{3}{4}$. It is almost never given internally.

ORDER III.—ANTACIDS.

Antacids are medicinal agents employed to neutralize acids in the blood, primæ viæ and secretions. The alkalies and alkaline earths and their carbonates are the substances included in this division. The alkalies, in the concentrated state, destroy organization and act as corrosive poisons; they are administered internally only in a state of extreme dilution. The alkaline carbonates produce a less intense chemical action on the tissues than the alkalies; and the bicarbonates are less active than the mono-carbonates.

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[*] Woodman and Tidy, 1882, p. 169.

[†] *Guy's Hosp. Reports*, 1851, p. 214.

[‡] *Montreal Med. Journ.*, Aug., 1888.

The alkaline earths, particularly magnesia, are less energetic in their local action than the alkalies proper; and their carbonates manifest little or no chemical influence upon the tissues.

When swallowed in a state of dilution, the *alkaline preparations* combine with the free acids which they encounter in the stomach. The salts which are thus formed, unless carried off by the bowels, are absorbed into the blood, and are thrown out by the secretions, especially by the kidneys. It must be remembered that, as already stated (see p. 254), alkalies increase acid and diminish alkaline secretions, when in contact with the orifices of the glands which secrete them. In like manner, acids increase alkaline and diminish acid secretions (Ringer) (see pp. 177, 258). While in the intestines, besides neutralizing acids, the alkalies also promote the digestion and absorption of fatty substances, by forming with them an emulsion. After absorption they exert a liquefacient action on the blood, and render the urine alkaline. Their long-continued use disorders the functions of digestion and nutrition, produces a chronic deterioration of the blood, and sets up a cachectic condition somewhat analogous to scurvy.

In the *concentrated* form the alkalies are employed as *escharotics*. The various alkaline preparations are administered *internally*, in the diluted form—1. As *antacids*, in dyspepsia accompanied with excess of acid in the primæ viæ, and they are probably also of advantage in dyspeptic cases, by promoting the digestion of fatty matters. As dyspepsia with acidity probably depends frequently on fermentation of the ingesta, due to deficient secretion of acid gastric juice, the administration of the alkalies would prove of advantage, not by neutralizing the acid in the stomach, but by correcting the deficiency of the secretion on which the dyspepsia depends. If the condition, on the other hand, depend on a profuse secretion of acid, then the administration of the alkalies can do nothing more than palliate, by neutralizing, the excessive acidity. When the alkalies are exhibited before meals, they increase the acid secretion of the gastric mucous membrane; given after meals they neutralize the excess of acid. Acids taken before meals decrease the amount of acid secreted by the stomach; while, if given after meals, they will supply the place of the acid of the gastric juice, should there be a deficiency in that secretion. The vegetable tonics and aromatics are frequently combined with antacids advantageously, in the treatment of dyspepsia. 2. To relieve irritability of the stomach and check vomiting 3. As *antidotes* in cases of poisoning from acids. 4. As *antilithics*, to neutralize uric acid when it is separated in undue quantity by the urine; and also as *lithontriptics*, or solvents of calculi, especially urates. They are *improper* when there is a tendency to the deposition of phosphates; and in treating cases of uric acid deposit it is unnecessary to render the urine more than neutral, as, if it be made alkaline, the phosphates formed may be deposited round the uric acid calculi. 5. In the treatment of acute rheumatism and gout, where they act by neutralizing the excess of acid with which the blood is charged in these diseases. 6. To relieve irritability of the urinary organs—ardor urinæ in gonorrhœa—cutaneous irritation—uterine irritation—pruritus ani, etc.—especially when these conditions of irritability are dependent, as is often the case, on excess of acid in the system. 7. As *diuretics*. 8. As *antiplastics* and *resolvents*, in inflammation. And, 9. By many therapeutists, in diabetes mellitus.

The antacid preparations should be administered in a state of large dilution, with a view to facilitate their absorption, and to prevent an irritant and purgative action on the bowels.

POTASSII PRÆPARATA—POTASSIUM PREPARATIONS.

The preparations of potassium employed as antacids are the *Solution of Potassa*, *Potassium Carbonate* and *Potassium Bicarbonate*.

The general effects of the potassium preparations are those previously described (see p. 253). They increase both the solid and watery portions of the urine, and in large doses render it alkaline. Under their use, however, the uric acid, either free or combined, is greatly diminished, and, it is asserted, is converted into oxaluric acid, which is metamorphosed into oxalic acid and urea.

Liquor Potassæ (*Solution of Potassa*) is prepared by the action of lime on a solution of potassium bicarbonate; the lime abstracts carbonic acid from the bicarbonate, and precipitates as calcium carbonate, leaving the potassium hydrate in solution; or it may be made, more directly, by dissolving potassa, 56 parts, in distilled water, 944 parts. Solution of potassa is a limpid, colorless liquid, without smell, of a very acrid, caustic taste, an alkaline reaction, and imparts a soapy feeling to the fingers when rubbed with it; sp. gr. 1.036; it contains 5 per cent. of potassium hydrate (KHO).

INCOMPATIBLES.—With acids, acid salts, and all substances held in solution by the same agency; also with the ammoniacal salts, calomel and corrosive sublimate.

Aids.—Liquor sodæ.

Contraindications.—Phosphatic calculi, or the phosphatic diathesis.

Toxicology and Antidotes.—In excessive quantity it acts as an irritant and corrosive poison; vegetable acids should be administered as a chemical antidote, and oils as a protective.

Effects and Uses.—The *antacid*, *diuretic*, *antilithic* and *resolvent* properties and indications of this preparation have been described above. It is more irritant to the stomach than the potassium carbonates, and is therefore less eligible for protracted use. To render the urine alkaline in *acute cystitis*, Sir H. Thompson prefers it to the carbonates and citrates, as it is less diuretic. For the same reason it is useful in *gonorrhœa* and *strangury*. It may be administered to neutralize gastric acidity in *heartburn* and *eructations*, possessing the advantage over the carbonates of not giving off carbonic acid gas.

Administration.—Dose, gtt. x–xx, largely diluted with sweetened water or mucilage. *Externally* it is used in a diluted state as a stimulant lotion in *prickly heat* and *freckles*, and to *acne* when the skin is greasy.

Potassii Carbonas (*Potassium Carbonate*, commonly called *Salt of Tartar*). This salt is prepared by calcining potassium bicarbonate, which is thus deprived of a molecule of carbonic acid and reduced to the state of carbonate ($2KHCO_3=H_2CO_3+K_2CO_3$). Potassium carbonate occurs in the form of a white, coarse, granular powder, of a nauseous, alkaline taste and an alkaline reaction, very soluble in water, but insoluble in alcohol. It is very deliquescent, forming, if long exposed to the air, an oily liquid with the water, which it attracts.

Incompatibles.—Acids, acidulous salts, calcic hydrate and chloride, magnesium sulphate, ammonium chloride and acetate, alum, tartar emetic, iron sulphate and tincture of ferric chloride.

Contraindications.—Same as for liquor potassæ.

Toxicology and Antidotes.—In large quantities it acts as a corrosive poison, for which vegetable acids are the chemical antidotes. Fixed oils should be given to protect the stomach. So much as f℥iij of a concentrated solution has been swallowed without fatal results.

Effects and Uses.—It is employed as an *antacid*, *antiplastic*, *diuretic*, *antilithic*, etc., in the dose of gr. x–xx, in some sweetened aromatic water. It has been found specially useful in *torpor of the liver*, in *dyspepsia* as an antacid, and as an antilithic in the *uric acid diathesis*.

Potassii Bicarbonas (*Potassium Bicarbonate*) is made by passing carbonic acid through an aqueous solution of purified pearl-ash (a more or less impure potassium carbonate), obtained from wood-ashes by lixiviation, and somewhat purified by solution in water, filtration and evaporation, till it is fully saturated. It occurs in transparent, colorless crystals, having the shape of irregular eight-sided prisms with two-sided summits ($KHCO_3$). They are inodorous, of a slightly alkaline taste, permanent in the air, soluble in water, and insoluble in alcohol.

Incompatibles.—Same as for the carbonate, except no precipitate is formed with calomel or Epsom salt.

Effects and Uses.—These are similar to those of the carbonate, but it is pleasanter in taste and less irritant to the stomach. It is much used in *gout* and the *uric acid diathesis*. It is a good remedy in *acute rheumatism*, in which as much as ℥jss may be given during the day, with opium to relieve pain. Dose, gr. xx–ʒj.

*Fuller's alkaline** treatment of *acute rheumatism* consists in giving large doses so as to thoroughly alkalinize the system, together with the strictest attention to the diet and the administration of tonics, as quinine, as soon as the system will tolerate them. He gives of potassium bicarbonate not less than ℥jss in the first twenty-four hours, either alone or in combination with a vegetable acid largely diluted with water. When the urine becomes neutral the bicarbonate is reduced to a quantity just sufficient to keep it so (from ʒ¼–½ thrice daily). Of 439 cases treated by this plan, in only 2 per cent. were cardiac complications discovered. Fuller's treatment is best adapted to the obese and plethoric.

SODII PRÆPARATA—SODIUM PREPARATIONS.

The sodium preparations are *analogous* in effects to those of potassium. Ringer and Sainsbury† have shown that they stop the extirpated frog's heart in diastole. Schoenlein‡, too, found that sodium carbonate acted directly on the heart and not through the nerves. In regard to their relative poisonous activity, the former ascertained that potassium stands first, then ammonium, while sodium possesses only slight toxic power. Being less irritant and less depressing, they are better as antidyspeptics, and for the relief of acidity of the primæ viæ. They are inferior in gout and the uric acid diathesis, as they are less powerful solvents of the acid. Their eliminative action as diuretics is also more feeble.

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* *The Practitioner*, Vol. II, p. 129.

† *Lancet*, 1882, p. 736.

‡ *Arch. f. d. Ges. Physiol.*, XVIII, p. 26.

Liquor Sodæ (*Solution of Soda*) is prepared by the action of lime on a solution of sodium carbonate, or by dissolving soda 56 parts in distilled water 944 parts. It is a colorless liquid, having an extremely acrid taste and a strong alkaline reaction. It has sp. gr. 1.059, and contains 5 per cent. of sodium hydrate (NaHO). The dose, administration and incompatibles are the same as those of liquor potassæ.

The preparations of sodium generally employed as *antacids* are the *carbonates*. There are several sources of carbonated sodium. The native carbonate (called *natron*) is found in Egypt, Hungary and other countries. Impure soda, obtained from the ashes of marine plants, is termed *barilla* or *kelp*—barilla when it is derived from phenogamous plants growing near the sea, and kelp when procured from cryptogamic plants growing in the sea. Sodium carbonate is now, however, chiefly made by artificial means from sodium sulphate, which is obtained in part from the manufacturers of chlorinated lime, but principally by the action of sulphuric acid on sodium chloride. The sodium sulphate is fused with ground limestone and coal, and forms a black mass called *British barilla*, which contains a mixture of sodium carbonate and calcium sulphide—$Na_2SO_4 + C_4 + CaCO_3 = CaS + Na_2CO_3 + 4CO$. It is afterward purified by lixiviation, calcination and other processes. Within a few years past, caustic soda and the carbonates and other sodium salts have been manufactured near Pittsburgh, in Pennsylvania, from *cryolite* (a sodium and aluminium fluoride) ($3NaF,AlF_3$), which is found in an immense deposit in Greenland, and largely imported into Philadelphia. Sodium carbonate, too, has been found in large amount in a lake in Nevada.

Sodii Carbonas (*Sodium Carbonate*) ($Na_2CO_3.10H_2O$) crystallizes in large, oblique, rhombic prisms, which are transparent, very efflorescent, of an alkaline, disagreeable taste, soluble in water, but insoluble in alcohol. When heated they undergo the watery fusion and part with their water of crystallization, which is entirely expelled at a red heat. It is apt to contain sodium sulphate and chlorides as impurities.

INCOMPATIBLES.—Acids, acidulous salts, lime-solution, earthy and metallic salts, etc., are incompatible with sodium carbonate.

AIDS.—Liquor potassæ.

CONTRAINDICATIONS.—Phosphatic calculi, and the phosphatic diathesis.

TOXICOLOGY AND ANTIDOTES.—In overdoses it is a corrosive poison, for which acids and oils are the *antidotes*.

EFFECTS AND USES.—Sodium carbonate is *less irritant* and has a milder and more agreeable taste than potassium carbonate. Its effects are otherwise *similar*, and it is administered in the same cases.

ADMINISTRATION.—Dose, gr. x–xxx in powder, or dissolved in some bitter infusion. Owing to the variable quantity of water of crystallization which it contains, as kept in the shops, it is best given in the *dried* state.

Sodii Carbonas Exsiccatus (*Dried Sodium Carbonate*).—This salt is deprived of its water of crystallization by heat, and occurs in the form of a white powder. Dose, gr. v–xv in pill, made with soap and aromatics.

Sodii Bicarbonas (*Sodium Bicarbonate*) ($NaHCO_3$) is prepared by saturating the carbonate with carbonic acid. The half-dried carbonate is made to absorb carbonic acid, the water liberated during its solution being sufficient to dampen it. Thus obtained, the crystals have the form of the carbonate, retaining only one equivalent of water, but are opaque and porous. They occur usually in granular masses, or in the form of a white, opaque powder, which contains variable amounts of soda not fully saturated with carbonic acid, and is known as SODII BICARBONAS VENALIS (*commercial sodium bicarbonate*). This is purified for medicinal use by percolation with distilled water, and the purified salt occurs as a snow-white powder, soluble in 13 parts of water, of a mild, slightly alkaline taste. It is a permanent salt. By exposure to heat it gradually parts with its carbonic acid, and at a red heat is converted into the anhydrous carbonate.

INCOMPATIBLES.—With acids, acidulous salts, lime-water, ammonium chloride, the earthy and metallic salts.

CONTRAINDICATIONS.—Phosphatic calculi, and the phosphatic diathesis.

EFFECTS AND USES.—These are the same as those of the carbonate, but it is less irritant and of more agreeable taste. It is often combined with aromatics in *acid dyspepsia* or *flatulence*, and in *headache* due to these causes: ℞ Sodii bicarbonatis, ʒij; tincturæ nucis vomicæ, fʒij; tincturæ zingiberis, fʒiv; tincturæ capsici, fʒj; sacchari albi, ℥ss; aquæ menthæ piperitæ, q. s. f℥vj. M. S. Of this, a dessertspoonful may be taken three or four times a day. Sodium bicarbonate is an ingredient of *Seidlitz powders* (q. v.). A most serviceable alkaline-cleansing wash for *chronic nasal catarrh*, highly recommended by Morell Mackenzie, is composed of sodii carbonatis, sodii boratis, sodii chloridi, āā gr. vij, sacchari albi gr. xv, M. S.; dissolve in half a tumblerful of tepid water; to be used as a nasal douche. *Troches of sodium bicarbonate* contain sodium bicarbonate, sugar, nutmeg, and mucilage of tragacanth, each troche containing gr. iij of the bicarbonate. *Externally*, sodium bicarbonate may be sprinkled with advantage over *burns* and *scalds;* or a solution of ℥½ to water Oij may be applied to the parts, on lint, to alleviate the pain (McClellan* and Spring†). Equal parts of it and common salt make a good application to the *bites of bees, hornets, and spiders.*

ADMINISTRATION.—Dose, for an adult, gr. x–xxx, which may be pleasantly taken in carbonic acid water.

Sternberg's ‡ *alkaline treatment of yellow fever*, for which excellent results are claimed, consists in administering a certain amount of sodium carbonate with a minute portion of corrosive sublimate as follows: ℞ Sodii bicarbonates ℥iv, hydrargyri corrosivi sublimati gr. ½, aquæ Oij. M. S. Take 1¾ ounces every hour.

ALKALINE MINERAL WATERS—NORTH AMERICAN.

St. Louis Spring (*Gratiot County, Michigan*). Analyst S. P. Duffield, M. D. Temperature 50° Fahr. One pint contains chiefly sodium carbonate, gr. 7.684; magnesium carbonate, 1.080; iron carbonate, 0.091; calcium carbonate, 5.019; calcium sulphate, 6.925; carbonic acid gas, 136 cubic inches; hydrogen sulphate, trace. A strongly alkaline water containing a little iron; particularly beneficial in *dyspepsia* with acidity; *neuralgia* and *chronic rheumatism.*

Capon Springs (*Hampshire County, West Virginia, elevation*

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* *Louisville Med. News*, 1878, p. 108, † *Phila. Med. Times*, March, 1878, p. 273.

‡ *Therap. Gaz.*, May 15th, 1889.

1800 feet above the sea). Contains sodium and magnesium carbonates, also iodine and bromine, and is highly charged with carbonic acid gas. Temp. 66° Fahr., has but litle odor. Employed in *acid dyspepsia*, the *uric acid diathesis* and *chronic cystitis*.

Poland Spring (*South Poland, Maine*). Analyst, Prof. C. F. Chandler. One U. S. gallon contains potassium sulphate, gr. 0.1562; sodium chloride, 0.2636; sodium carbonate, 0.1333; calcium carbonate, 1.2287; magnesium carbonate, 0.5412; silica, 1.1197; organic and volatile matter, 0.2332. Total solids, 3.6759.

Bedford Chalybeate Spring (*Bedford County, Pennsylvania*). One U. S. gallon contains, calcium sulphate, gr. 2.741; calcium carbonate, 8.885; magnesium carbonate, 1.201; iron carbonate, .442; sodium carbonate, .395; potassium carbonate, .132; sodium chloride, .120; silicic acid, .793; calcium phosphate, .033. Total solids, 14.942. Carbonic acid gas, 12 cubic in. The conditions in which these waters prove of service are the *uric acid diathesis*, *chronic rheumatism*, *gout*, *diabetes mellitus*, *acute* and *chronic Bright's disease*, *renal calculi*, *jaundice*, *gall-stones*, and *acute* and *chronic hepatitis*.

ALKALINE MINERAL WATERS—EUROPEAN.

Apollinaris (*Valley of the Ahr, Rhenish Prussia*). One pint contains sodium carbonate, gr. 6.964; magnesium carbonate, 2.751; calcium carbonate, 1.900; sodium chloride, 2.743; sodium sulphate, 1.548; oxide of iron with alumina, 0.049; silicic acid, 0.099; total solids, 16.054. Gases: carbonic acid, free and semi-combined, cub. in. 42.81; carbonic acid combined, 12.44. An agreeable and palatable alkaline mineral water, extensively taken as a table-water.

Vichy (*France*); **Ems** (*Germany*); **Fachingen** (*Germany*). The Vichy waters do not act on all alike. To some they prove purgative, to others diuretic; but they invariably render the urine alkaline. There are nine springs in all the temperature of which ranges from 53° to 110° Fahr., and they are employed as baths as well as internally. Taken during or after digestion they check acidity; administered before they augment the acid gastric secretion. The Ems waters increase the urinary secretion and perspiration, render the urine alkaline, and tend to produce constipation. The Vichy waters are prescribed in *dyspepsia* with acidity and constipation; in *biliary calculi*, *gall-stones*, *renal calculi*, *gout*, *diabetes mellitus*, *malarial cachexia*, and to neutralize the urine in *strangury*.

The *Ems* waters, which are limpid and soft to the touch, are prescribed with benefit in *chronic bronchitis*, *pharyngitis*, *chronic cystitis*, and *endometritis*. The Fachingen waters are used in the same way as the Vichy. There is no resort at the latter spring.

ANALYSIS.

ONE PINT CONTAINS	VICHY, GRANDE GRILLE. 105.8° FAHR. BOUQUET.	FACHINGEN. 50° FAHR. FRESENIUS.	EMS, KESSELBRUNNEN. 115° FAHR. FRESENIUS.
	grains.	grains.	grains.
Potassium carbonate	2.04	. . .	. . .
Sodium carbonate	26.00	19.4763	10.5379
Magnesium carbonate . . .	1.38	1.3580	0.8510
Iron carbonate	0.02	0.0801	0.0202
Magnesium carbonate . . .	trace	. . .	0.0035
Calcium carbonate	2.31	2.1010	1.2591
Lithium carbonate	. . .	0.0004	. . .
Strontium carbonate	0.01	0.0007	0.0030
Barium carbonate	. . .	. . .	0.0030
Sodium chloride	4.10	4.5574	7.7705
Calcium chloride	. . .	0.0034	. . .
Potassium sulphate	. . .	. . .	0.3937
Sodium sulphate	2.29	0.1372	0.0061
Sodium phosphate	0.78	0.0506	. . .
Aluminum phosphate . . .	. . .	0.0003	0.0096
Calcium phosphate	. . .	0.0004	. . .
Lithium phosphate	. . .	0.0002	. . .
Silicon phosphate	. . .	0.2610	. . .
Calcium fluoride	. . .	0.0027	. . .
Sodium biborate	trace	. . .	. . .
Sodium arseniate	0.01	. . .	. . .
Silica	0.05	. . .	0.3648
Total	38.99	27,9397	21.2194

GASES.	cub. in.	cub. in.	cub. in.
Carbonic acid	14.74	32.975	67.88

LITHII PRÆPARATA—LITHIUM PREPARATIONS.

Lithium is found in several minerals, as lepidolite, etc., but in minute amount. It is extracted chiefly by the agency of sulphuric acid; the sulphate is converted into a chloride by a solution of barium chloride, and from the chloride, the CARBONATE (*Lithii Carbonas*) (Li_2CO_3) is prepared by the addition of ammonium carbonate. It is a white powder of a mildly alkaline taste, soluble in 130 parts of water, more soluble in carbonic acid water, and insoluble in alcohol.

Incompatibles.—With acids, acidulous salts and the agents that decompose the alkalies.

Effects and Uses.—The lithium salts act on the system in a *similar* manner to the other alkalies. They are said to render the urine more alkaline than do the other members of this group. Lithium carbonate is a very valuable antacid in *gout* and *rheumatism*, from the fact of its low combining number and the great solubility of the lithium urate, thus enabling the carbonate to act powerfully in eliminating uric acid from the system. Garrod* who first called attention to lithium in the treatment of gout, experimentally proved its efficiency as a solvent of uric acid deposits by placing a metacarpal bone and bit of cartilage, both of which were infiltrated with gouty nodules, in a solution of lithium carbonate, which in a few days dissolved away the deposit. It probably also diminishes the formation of uric acid, and the author has found it highly efficacious in the cure of *gout*. It is, too, a good diuretic.

Administration.—Dose, gr. v–x two or three times daily, largely diluted and best given in carbonic acid water.

Lithii Citras (*Lithium Citrate*) ($Li_3C_6H_5O_7$), a deliquescent white powder, soluble in 2.5 parts of water, is made by adding a solution of citric acid to the lithium carbonate. It is converted into a carbonate in the system, and is, therefore, possessed of the same properties, but is more refrigerant. Strong solutions of the lithium salts have been found useful *externally* in removing *gouty enlargements*.

Lithii Benzoas (*Lithium Benzoate*) ($LiC_7H_5O_2$) is prepared by the gradual addition of benzoic acid to a heated watery solution of the carbonate, and evaporating. It may be obtained in the form of glistening pearly scales, of a soapy feel and a cool, sweetish taste, soluble in three and a half parts of water at 60°. The ready solubility of this salt and its freedom from deliquescence, and the benzoic acid which it contains in combination, give it especial value in the treatment of the various forms of disease dependent upon *uric acid deposits*. Dose, gr. iij–v repeated.

LITHIAN MINERAL WATERS.

Ballston Spa (*Saratoga County, New York*). Analysis of the Ballston Lithium well by Prof. C. F. Chandler; temperature 52°

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* "Gout and Rheumatic Gout," 1859, p. 435.

Fahr. In addition to lithium carbonate of which there is gr. ¾ to the pint, this water contains a large quantity of sodium chloride, calcium and magnesium carbonates.

Saratoga Springs (*New York, Pavilion Spring*). This yields in addition to the carbonates and sodium chloride about gr. ¾ of lithium carbonate to the pint.

These waters are useful in *gout, chronic rheumatism*, and the *uric acid* and *gouty diatheses.*

AMMONII PRÆPARATA—AMMONIUM PREPARATIONS.

The preparations of ammonia (previously noted under the head of *Stimulants*, p. 220) are administered as *antacids*, in cases in which a *stimulant* action is not objectionable. *Spiritus ammoniæ aromaticus* (*aromatic spirit of ammonia*) is the preparation usually employed, and is an excellent antacid carminative in *heartburn* attended with flatulence, *nausea with syncope*, etc. Dose, gtt. xxx–f℥j.

MAGNESII PRÆPARATA—MAGNESIUM PREPARATIONS.

Magnesia (q. v.) and its *Carbonate* (q. v.) are employed as antacids in *dyspepsia, sick headache, gravel*, etc., particularly where a laxative effect is also desirable. Dose, gr. x–xxx. *Troches of magnesia* are made by mixing magnesia, nutmeg, sugar, and forming with mucilage of tragacanth a mass, each troche containing gr. iij of magnesia.

CALCII PRÆPARATA—CALCIUM PREPARATIONS.

The preparations of calcium employed as antacids, are *Lime-solution, Precipitated Calcium* and *Prepared Chalk.* They are very useful in cases of acidity or irritability of the stomach, but their action on the bowels is the reverse of that of magnesia, and hence they can hardly be administered where there is a tendency to constipation. They are also much employed in diarrhœa.

Liquor Calcis (*Lime-Solution, Lime-water*) is a saturated solution of lime in distilled water. It is a colorless, inodorous liquid, of a disagreeable alkaline taste, containing about 0.15 per cent. of calcium hydrate (Ca2HO). By exposure to the air it gradually absorbs carbonic acid, with the formation of insoluble calcium carbonate. It should, therefore, be kept in full, well-stoppered bottles, or they should contain some undissolved lime.

INCOMPATIBLES.—With sulphuric acid, ammonium phosphate, sodium carbonate, potassium carbonate, magnesium sulphate, ammonium chloride, alum; the lime carbonate with acids and acidulous salts.

Contraindications.—Oxaluria.

Effects and Uses.—Lime-water combines *antacid* and *astringent* properties, and is applicable to all the cases in which antacids are proper, where an astringent effect on the bowels is not objectionable. It is an excellent remedy in *gastric irritability*, attended with nausea and vomiting, and may be given mixed with an equal part of milk, which disguises its unpleasant taste. A diet of milk and lime-solution is very useful in *dyspepsia*, accompanied with vomiting of food. Lime-water is employed also in *acute diarrhœa* after the inflammation has been subdued; in *diabetes mellitus*, and in *pyrosis*. *Externally* it is used as a lotion in *tinea capitis*, *prurigo*, *scabies;* as a mouth wash in *fetor of the breath*, *sordes* and *mercurialismus;* as an application to *foul ulcers*, and as an injection in *leucorrhœa* and *gleet.* Atomized inhalations of lime solution have been found useful in *diphtheria* and *membranous croup.*

Administration.—Dose, internally, f℥ss–iij–iv several times a day; for children, fʒj. *Linimentum calcis* (*lime-liniment*) (equal parts of lime-solution with cotton-seed oil, sometimes called *carron oil*) is an invaluable liniment in *burns* and *scalds*, and in *small-pox.*

Syrupus Calcis (*Syrup of Lime*) contains 5 per cent. of lime and 30 per cent. of sugar. It has been *used* as an astringent in *diarrhœas*, and as an antidote to poisoning by carbolic acid. It is much stronger than lime-water, ♏xx of the syrup being equal to f℥j of the latter. Dose, fʒss–ij, well diluted.

Calcii Carbonas Præcipitatus (*Precipitated Calcium Carbonate*) ($CaCO_3$) is made by mixing boiling solutions of calcium chloride and sodium carbonate. It is a fine white powder, insoluble in water, and free from grittiness, but possessing no superiority over *prepared chalk.*

Creta Præparata (*Prepared Chalk*) ($CaCO_3$) is made from *chalk* or *whiting* by levigation and elutriation. It occurs in little white conical loaves, which are tasteless, odorless, insoluble in water, but soluble in carbonic acid water.

Effects and Uses.—Its effects are those of an *antacid* and *desiccant-astringent.* It is prescribed in *dyspepsia* and *gout* attended with an excess of acid in the system; also in *diarrhœa;* and as it forms soluble calcium salts with the acids of the stomach, its employment has been suggested in *rachitis*.

ADMINISTRATION.—Dose, gr. x–xxx, in powder or suspended in water with gum and sugar. *Pulvis cretæ compositus* (*compound chalk-powder*) is made by mixing prepared chalk (30 parts) with powdered acacia (20 parts), and sugar (50 parts). *Mistura cretæ* (*chalk-mixture*) consists of compound chalk-powder (20 parts) mixed with water and cinnamon-water (40 parts of each); dose, f℥ss, repeated. Laudanum and tincture of kino or of catechu, and aromatics, are often added to this mixture in the treatment of *acute diarrhœa*. *Troches of chalk* are made by mixing prepared chalk, acacia, nutmeg and sugar, and forming a mass with water; each troche containing gr. iv of prepared chalk.

CALCAREOUS WATERS—NORTH AMERICAN.

Catoosa Springs (*Catoosa County, Georgia*) contain calcium sulphate gr. 39, with magnesium sulphate and carbonate gr. 34, and carbonic acid gas gr. 4¼ to the gallon.

Tate Epsom Springs (*Granger County, Tennessee*). Calcium sulphate is the chief ingredient, gr. 160 to the gallon; also Epsom and common salt. Temperature, 55° Fahr.

CALCAREOUS WATERS—EUROPEAN.

Contrexville and **Bagnères-de-Bigorre** (*France*), **Leuk** (*Switzerland*), and **Wildungen** (*Germany*). The most important ingredients in these waters are calcium carbonate and sulphate with small quantities of iron carbonate and carbonic acid gas. Their temperature varies, Contrexville being 54° Fahr., and Leuk, the highest, 123° Fahr. The Contrexville water is highly diuretic and diaphoretic, producing some phenomena of excitement. It is particularly useful in the *uric acid diathesis*, *gravel*, *renal calculi* and *chronic cystitis*. Their good effects seem to be due to a thorough flushing out of the urinary apparatus more than to anything else. The waters of Bagnères-de-Bigorre are reputed sedative in nervous conditions; but the fresh mountain air of the neighborhood may have something to do with it. Those of Leuk, which on account of their high temperature act freely on the skin, are employed in the form of baths for the treatment of cutaneous maladies as *lichen*, *chronic eczema*, *psoriasis* and *phthiriasis*. The Wildungen water is used in the same affections as the Contrexville.

CLASS IV.—TOPICAL MEDICINES.

ORDER I.—ANTISEPTICS AND ANTIPYRETICS.

Antiseptics (ἀντί, against, and σηπτός, putrid) are remedies which prevent fermentation and decomposition by a poisonous influence on the protoplasmic germs on which those processes depend, while *antipyretics* (ἀντί, against, and πῦρετός, fever) are those which reduce the temperature of the body, such action being particularly conspicuous when the body heat is elevated by a febrile process, and almost *nil* in the normal state.

The antiseptic and the antipyretic properties of many substances of this group bear a definite relation to each other, so that they are powerful in lowering febrile temperatare in the same ratio as they are destructive to lower forms of life, and especially is this the case with the lower members of the aromatic series of carbon compounds.

The theory of putrefaction which, based upon the researches of Pasteur, has been steadily gaining ground and is now almost universally adopted, refers the changes which take place in decomposing matter to the agency of organized germs ever present in the atmosphere, which, finding a suitable nidus in putrescible material, grow and multiply, producing chemical decomposition as a result of their presence. As in many diseases (*e. g.*, relapsing fever, diphtheria, etc.) certain organized germs have been found to take an essential part in the diseased process, if not to produce it, and as their presence is suspected in many diseases in which as yet they have not been demonstrated to exist, the importance of a group of agents which are destructive to these low forms of life can hardly be exaggerated. The extent to which this group of remedies will destroy disease-germs in the body without injuring the vitality of the human being, cannot be definitely laid down. Certain it is that as yet we possess very few specifics in medicine, especially against the zymotic diseases, which would appear *a priori* to be especially the class to which antiseptics would apply. Yet as many antiseptics are also antipyretics, they are not without use in the diseased economy, even if they do not cut short the morbid process.

When applied *topically* antiseptics are of great value, not only as deodorants and disinfectants, but also as germicides in dressing wounds, ulcers, etc., as in Sir Joseph Lister's antiseptic method or its various modifications. They are also useful to prevent the spread of disease when added to the excreta of patients suffering from contagious affections.

Antipyretics act* chiefly either to *lessen the production of heat* by retarding oxidation, and consequently cell-proliferation and chemical and molecular changes in the tissues, or by depressing the circulation either of the part (local abstraction of blood, blisters, etc.), or of the system at large (sedatives); or *increase the loss of heat* by increasing the evaporation of perspiration from the surface (diaphoretics); by dilating the cutaneous vessels and thus promoting heat-radiation (alcohol, amyl nitrite, spirit of nitrous ether), or by abstracting heat directly from the surface (cold applications of drinks). Many of the antipyretics (*e. g.*, sedatives, sudorifics, quinine, etc.), as well as of the antiseptics (alcohol, iodine, quinine and solutions of various metallic salts), have already been discussed, and it now remains to study those articles of the former group which are used to lessen heat production chiefly by retarding oxidation, as well as those remedies particularly employed as topical antiseptic agents.

POTASSII PERMANGANAS—POTASSIUM PERMANGANATE.

Preparation and Description.—This salt is made by mixing together equal parts of manganese dioxide and potassium chlorate, dissolving in a little water, evaporating to dryness, and exposing to a nearly red heat. Potassium permanganate ($K_2Mn_2O_8$) occurs in the form of slender prismatic crystals of a deep purple color, inodorous and of a sweetish, astringent taste. It dissolves readily in water, making a beautiful lilac-solution, which is readily decolorized by Fowler's arsenical solution and organic matters.

Effects and Uses.—There is little experience as regards the action of this salt when administered *internally*, although alterative effects are attributed to it (and probably with reason) in poisoned conditions of the blood, as in *malignant fevers*, *diphtheria*, *pyemia*, *erysipelas*, *puerperal fever*, etc. It is also used with success in *amenorrhœa* (Ringer), especially when of a purely functional character. It may be administered in gelatin-capsules; dose, gr. j–ij

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* "A Text-book on Pharmacol., Mat. Med. and Therapeut." London, 1885, pp. 53 and 366. By T. Lauder Brunton.

t. d., taken for five days or a week before the expected period. It is, however, as a powerful disinfectant that it now claims chief attention, and it now ranks at the head of this class of agents in destroying fetid odors and poisonous organic emanations. Its power in this respect is due to the evolution of oxygen in its more active form, *ozone.*

It is used *externally* in dressing foul and fetid or gangrenous *ulcers,* particularly those of *hospital gangrene,* as an application to *carbuncles,* as a gargle in *diphtheria,* as an injection into the cavity of *abscess,* and *bubo,* and injected into the wound caused by the *bites of insects* or *venomous snakes.* It may be sprinkled in powder on *gangrenous surfaces, phagedena,* or applied in solution of the strength of ʒ½j–ij to a pint of water. As a *disinfectant* and *deodorizer,* a solution of from one to ten grains to an ounce of water may be exposed in saucers or sprinkled on the floor, or thrown into the air in spray by the atomizer.

ADMINISTRATION.—One to three grains may be given *internally* made into pills with cacao-butter and vaseline, or taken in gelatin-capsules through the day. *Condy's Fluid* contains gr. ij to the f℥j. It is used for a variety of purposes where a disinfectant and deodorizer are indicated, as *bedsores,* a wash in *ozœna,* a mouth-wash in *sordes, fetor of the breath,* and to correct *fetor of the feet.* As an *injection in gonorrhœa* potassium permanganate (gr. ij to water f℥j) is highly efficacious, especially where a profuse yellowish discharge exists. In using this remedy, care must be taken to avoid the introduction of organic matter into the solution, which, by reducing the salt to an oxide, will destroy its efficiency. A good plan is to make the solution as required. Milton* states that nothing approaches it in point of efficiency as an injection in gonorrhœa. In the same way it may be employed in *gonorrhœa of the female* and *urethritis.*

AQUA CHLORI—CHLORINE-WATER.

This is an aqueous solution of *chlorine,* and should be kept in a cool place, protected from the light, but it is soon decomposed. It contains at least 0.4 per cent. of the gas. It occurs as a greenish-yellow liquid, having an astringent taste and the suffocating odor of the gas.

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* "On Gonorrhœa," etc., 1887, p. 201.

Effects and Uses.—Chlorine acts as a disinfectant and deodorizer, chiefly by its affinity for the hydrogen of moisture and the liberation of oxygen; its gaseous form gives it advantages in this respect. It is seldom used *internally*, but has been employed in essential *malignant fevers*, as *scarlatina* and *typhus*, and as an antidote for hydrocyanic acid. *Externally* it is used, diluted, as a wash in skin-diseases, as an antiseptic, and by inhalation in bronchial affections. Solutions containing chlorine and other antiseptics are useful applications to suppurating surfaces, by preventing the decomposition of pus, and thereby pyemia. In case of poisoning by chlorine-water, albumen is the best antidote. Dose, f℥j–iv, diluted.

CALX CHLORATA—CHLORINATED LIME.

Preparation and Description.—This agent, often called *chloride of lime*, is prepared by passing chlorine over calcium hydrate till saturation is effected, and is said to be principally a mixture of calcium hypochlorite and chloride ($CaCl_2O_2$ and $CaCl_2$). It occurs as a loose, grayish-white powder, or friable lumps, dry or but slightly moist, readily soluble in water, of a bitter, caustic taste and a faint odor of chlorine. Exposed to air and moisture, it slowly yields hypochlorous acid ($HClO$), and this soon breaks up into water, chloric acid ($HClO_3$), and free chlorine, and the chloric acid again yields chlorine; 25 per cent. of chlorine should be furnished by good chlorinated lime.

Effects and Uses.—Its effects are essentially those of chlorine, like which it decomposes sulphuric and hydrocyanic acids, and should not be given with the mercurials, or carbonates. It has been used as an alterative in *typhus*, *malignant scarlatina*, etc., in doses of gr. j–v, in solution, several times a day; and as a wash, *externally*, one part dissolved in a hundred parts of water; or as a paste. It is chiefly, however, as a *disinfectant* that it is employed.

Liquor Sodæ Chloratæ (*Solution of Chlorinated Soda*) ($NaCl$,-$NaClO$), sometimes termed *Labarraque's Disinfecting Liquid*, is made by decomposing a solution of sodium carbonate by one of chlorinated lime. It is a transparent, greenish-yellow liquid, with a faint smell of chlorine, a sharp saline taste and an alkaline reaction. It has been used *internally*, to fulfill the same indications as chlorinated lime, in dose of ♏x–f℥j, diluted, several times a day. It is useful, also, in dilution of various strengths, as an *external* application to every form of *fetid ulcer*, as a mouth-wash in *mercurialismus*, and is a most valuable and powerful *disinfectant.*

Hydrargyri Chloridum Corrosivum (*Mercuric Chloride*).

EFFECTS AND USES.—Corrosive sublimate (q. v.) is very destructive to the lower forms of life, and is largely used for this purpose in the treatment of various surgical affections. It is employed in solutions (1 to 1000, – 1 to 8000) as a prophylactic to cleanse the surface of the patient, and the hands, instruments, and sponges of the surgeon, previous to an operation, and in the form of corrosive sublimated gauze, or cotton, as a dressing after the operation is finished, and thus prevent the entrance of the germs on which depend suppuration, erysipelatous, or diphtheritic inflammation, and other complications of wounds.

To destroy germs when already present, it is also useful. Thus, in the treatment of *abscesses*, either *acute* or *chronic*, after evacuating the contents through a small incision, the cavity should be superdistended with the corrosive sublimate solution (1–1000 or 1–2000) and the fluid retained from two to five minutes, when it should be allowed to drain off, after which the injection is to be repeated until the fluid flows away as clear as when introduced. In this way we destroy the protophytes on which these forms of suppuration depend, and thus hasten the growth of granulations. In *psoas, iliac or lumbar abscess* this method of treatment probably gives the best results, and deep-seated mammary abscesses may be rapidly healed by its employment.

As numerous cases of poisoning are recorded, it is better to decrease the strength of the solution or to discontinue its use, and employ pressure to bring the walls of the abscess together, after a few days, when healthy granulations are springing up.

As an injection in *gonorrhœa*, a weak solution (1–8000, or better, 1–12,000) may be used to destroy the gonococci, but even then severe pain and violent inflammation may be excited in the male urethra by such an injection. In *gonorrhœa of the female*, a corrosive chloride solution (1–8000) thrown into the vagina when the patient is in the recumbent position with the hips slightly elevated by a pillow is very efficacious.

In the treatment of *puerperal septicemia*, vaginal and even uterine injections are employed, care being taken in the latter case to throw the solution very slowly into the uterus, to be sure that it returns freely through the os uteri, to avoid the introduction of air into the uterus and to discontinue the injection should much pain be complained of or symptoms of syncope or collapse supervene.

It may be used not only as a dressing but also as a wash for all *wounds* and *ulcers* whatever.

ADMINISTRATION.—A solution of the required strength may be made as follows: ℞ Hydrargyri chloridi corrosivi, ʒj; divide in chart viij. Sig.—One powder dissolved in a pint of *hot* water forms a solution of 1 to 1000; or, as the powders are somewhat difficult of solution, ℞ Hydrargyri chloridi corrosivi, ʒj: alcohol, f℥ij. M. Sig.—fʒij, in a pint of water = 1 in 1000 parts. If the latter solution is to be kept for some time, it is well to add an equal weight of ammonium chloride to the corrosive sublimate to prevent the decomposition of the latter salt.

Compressed tablets are also kept in the shops, which are very convenient for making solutions. If mercuric chloride be used to disinfect instruments, they should not be allowed to remain in the solution, as otherwise mercury will be deposited on the surface of the metal, and the instrument tarnished. *Gauze*, *lint*, *cotton*, *wool*, *jute*, *saw-dust*, etc., are impregnated with solutions of corrosive chloride and used as surgical dressings.

Bromine (*see Escharotics*) and **Iodine** are antiseptics, acting in a manner similar to chlorine. They are seldom used for this purpose.

Hydrargyri Iodidum Rubrum (*Mercuric Iodide*) (q. v.) is also used in aqueous solution as an antiseptic (1 to 2000). It has not, however, replaced the mercuric chloride as a germicide.

Acidum Sulphurosum (*Sulphurous Acid*) contains about 3.5 per cent. of sulphurous acid gas in distilled water, and is made by heating sulphuric acid with charcoal and distilled water. The sulphuric acid is deprived of an equivalent of oxygen by the charcoal, and becomes sulphurous acid (H_2SO_3). It is a colorless liquid, having the smell of burning sulphur and a sulphurous, sour, and somewhat astringent taste.

EFFECTS AND USES.—It is a powerful deoxidizing agent, very destructive to vegetable life, and is believed to exert a similar influence on disease-germs. It is readily absorbed by the stomach, and is eliminated by the urine and feces as a sulphate. *Internally*, it is very efficacious in *sarcina ventriculi*, or yeast vomiting; dose, fʒj, largely diluted with water. *Externally*, it is used in skin-diseases of a parasitic nature, as *tinea circinata* and *versicolor* and *favus*, mopped on pure or diluted with two or three measures of water or glycerin. When the attacked parts are exposed, the face or neck for example, it possesses the advantage of not leaving a temporary stain.

Sodii Sulphis (*Sodium Sulphite*) ($Na_2SO_3.7H_2O$) is used as a substitute for sulphurous acid, which is developed from the salt by any of the organic acids. It occurs in white, efflorescent, prismatic crystals, of a sulphurous taste, soluble in four parts of cold and one part of boiling water.

ADMINISTRATION.—Dose, ʒj, three times a day; a solution (ʒj-f℥j of water) is a good *local* application in *erysipelas* and *aphthæ*.

Sodii Bisulphis (*Sodium Bisulphite*) ($NaHSO_3$) occurs in opaque, prismatic crystals or a crystalline or granular powder, slowly oxidizing and losing sulphurous acid on exposure to air, having a faint sulphurous odor and taste, soluble in 4 parts of cold and 2 parts of boiling water.

EFFECTS AND USES.—It is used as a substitute for sodium sulphite, to which it is preferred because of the greater proportion of sulphurous acid which it contains. Dose, gr. v-xx.

Sodii Hyposulphis (*Sodium Hyposulphite*) ($Na_2S_2O_3.5H_2O$) is used for the same purposes. It occurs in white, tabular crystals, of a pearly lustre and sulphurous taste, which are efflorescent, and very soluble in water and alcohol and insoluble in ether. Dose, gr. x-xx three times a day, and for *external use*, ʒj dissolved in water f℥j.

Potassii Sulphis (*Potassium Sulphite*) ($K_2SO_3.2H_2O$) occurs in white, opaque fragments or powder, of a saline and sulphurous taste, very soluble in water; its uses and doses are the same as those of sodium sulphite.

Magnesii Sulphis (*Magnesium Sulphite*) ($MgSO_3.6H_2O$) is also employed in zymotic diseases and in *flatulent dyspepsia*, to prevent the formation of gases in the alimentary canal. It is less unpalatable than the sodium salt, and besides contains a larger proportional quantity of acid. The sodium, potassium, and magnesium sulphites are employed in the treatment of purulent infection. *Calcium* and *ammonium sulphites* have been also recommended, but are not official.

The **Sulphides** appear to possess the power of checking the formation of pus. On this ground they are highly lauded in *boils, abscesses, carbuncles,* etc., by Dr. Ringer.

Calx Sulphurata (*Sulphurated Lime*) often misnamed calcium sulphide, consists chiefly of a mixture of "calcium sulphide and calcium sulphate in varying proportions, but containing not less than 36 per cent. of absolute calcium sulphide." It is recommended to check the formation of pus, in doses of gr. $\frac{1}{10}$ every hour. In eight cases of *chancroidal bubo* I found the use of calcium sulphide of doubtful service in promoting their resolution. The dose employed was gr. $\frac{1}{5}$–$\frac{1}{2}$ t. d. (C. B.).

ACIDUM BORICUM—BORIC ACID.

Preparation and Description.—Boric or Boracic Acid (H_3BO_3) exists in nature in volcanic regions, notably in Tuscany. In this region, which was formerly the main source of supply of this acid, jets of steam, called *suffioni*, escape through fissures in the hillsides, and are made to pass through a series of shallow basins along which water is slowly flowing. The water becomes charged with boric acid, which is converted into borax. A boiling concentrated solution of borax is slowly decomposed with an excess of sulphuric acid, and on cooling, boric acid is obtained in transparent six-sided crystalline plates, unctuous to the touch, odorless, slightly bitter, soluble in cold water, more so in alcohol and very soluble in boiling water. The supply to the United States is now derived almost exclusively from Borax Lake in California, about one hundred miles north of San Francisco.

Incompatibles.—With the carbonates and bicarbonates, carbonic acid is liberated; with the alkaline, earthy and metallic bases, borates are formed.

Physiological Effects.—Boric acid is *antiseptic* and *deodorant*, arresting fermentation and proving very poisonous to the lower forms of life. Neumann found by experiments on dogs, verified on rabbits and young pigs, that boric acid caused a decided fall in the temperature of the body, while large doses produced diarrhœa and vomiting. Three per cent. solutions injected into the serous cavities caused no inflammation, but when large amounts were injected the animal died from paralysis of the motor-nerves and muscles.*

According to J. Forster,† boric acid augments the amount of nitrogen and of solid matter excreted by the fèces, the increase being in direct proportion to the amount of the drug ingested. As small a dose as gr. vij daily will produce these effects.

Toxicology.—Mododewkow reports two fatal cases of poisoning with boracic acid. In one case a pleuritic cavity and in the other a lumbar abscess was washed out with a five per cent. solution of the acid, some of which remained in both cases. The symptoms were, persistent vomiting, hiccough, erythema beginning on the face, slight temporary rise of temperature, diminished cardiac power ending in paralysis. He suggests morphine and stimulants in like cases.‡

Medicinal Uses.—This medicament is rarely used internally, though Mr. Perez § recommends the *internal* use of boracic acid (gr. x, omn. trihor.) to prevent the formation of ammoniacal urine in the bladder in cases of *chronic cystitis;* and as it is said to pass through the kidneys unchanged, it is recommended as an antiseptic in *pyelonephritis*.

Boric acid is used *externally* as an antiseptic in the treatment of *wounds*, *burns*, *ulcers*, *abscesses*, *phlegmonous erysipelas*, *acute eczema*, etc. In these affections a saturated aqueous solution may be applied on sterilized cotton or gauze; in abscess after evacuation it should be injected into the cavity, gr. x–xx to water f℥j. A saturated solution is a good deodorizing application to correct *fetor of the feet*. It has also been used with advantage in inflammation of the mucous membranes, as *aphthæ*, *gingivitis*, *diphtheritic inflammations of the mouth*, etc., in the form of a gargle dissolved in water and glycerin. It may be dusted into the external auditory meatus in *otorrhœa* attended with suppuration. The parts should first be cleansed with tepid water, then dried, and the acid introduced by insufflation and retained by a cotton-plug. The same method of treatment is appliable to *myringitis*. It has been applied with advantage in inflammation of the *conjunctiva* (gr. v–x to aq.f℥j). Used as an *injection*, it appears to shorten the duration of *gonorrhœa*. Made into an ointment with vaseline or cerate (gr. x–xx to ℥j) it is an excellent antiseptic dressing for *wounds*. This form may be applied to the eye-lids in *blepharitis*, and to *fissure of the nipple*.

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* *N. Y. Med. Jour.*, Jan. 27th, 1863, quoted from *Lancet*.

† Dingl's Polytechnik Journ., No. CCLI, p. 170.

‡ Wratch, No. 31, 1881.

§ *Lancet*, July, 1884, p. 133.

SODII BORAS—SODIUM BORATE.

Sodium Borate or Borax occurs as a native product in several localities, the most important of which for a long time was Thibet, in Asia; it is also made artificially by the direct combination of native boric acid with soda. Borax ($Na_2B_4O_7.10H_2O$) occurs in the form of hexahedral prismatic crystals, terminated by triangular pyramids, of a sweetish alkaline taste and an alkaline reaction. It is wholly soluble in water, slowly effloresces, and possesses the property of rendering cream of tartar very soluble in water.

INCOMPATIBLES.—The mineral and vegetable acids decompose borax. With morphine and cocaine salts a precipitate goes down.

EFFECTS AND USES.—Borax is a *mild* refrigerant and diuretic, and *locally* an antiseptic, and has emmenagogue virtues attributed to it.

It has been given in *infantile diarrhœa* as an enema, and is used externally in cutaneous affections (ʒj to water Oj as a wash in *pruritus* and in *acne punctata*), but especially as a detergent in *aphthous affections* of the mouth in children, mixed with an equal quantity of sugar.

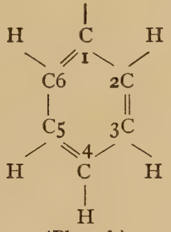
A piece of borax slowly dissolved in the mouth will often cure *acute hoarseness*. Glycerite of sodium borate may be made by rubbing up sodium borate ℥ij in glycerin Oss; honey of sodium borate may be made by mixing ʒj with clarified honey, f℥j. These preparations are used chiefly as applications to the mouth and throat. Dose, gr. xxx.

DERIVATIVES OF THE ORGANIC RADICAL PHENYL.

The eager search after a remedy which will replace quinine, has, within the last few years led to the discovery of medicinal qualities, hitherto undreamed of, in various chemical substances, particularly with regard to certain members of the *aromatic series* of the *carbon compounds*. While the remedies heretofore discussed under the head of antiseptics are chiefly used *externally* for their action as protoplasmic poisons, the group about to be studied are used *internally* for their antipyretic properties, and though most of them are also antiseptic, yet the latter action appears to be readily modified by slight changes in certain members of the group. Thus, while salicylic acid is antiseptic, its salts do not possess this property, and its isomers—meta- and para-oxybenzoic acids—have no such power.

As some knowledge of their chemical constitution is essential to the proper understanding of the relations existing between members of this group, a few remarks bearing on this subject will not be out of place here.

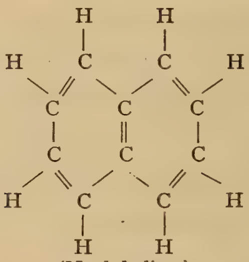
Phenyl, the organic radical of this group, consists of carbon 6 atoms united with hydrogen 5 atoms, the elements being arranged, according to the theory of Kekule, on which alone is it possible to explain the formation of its derivatives, in such a manner that the C. elements are united in a closed chain, exchanging with each other alternately one and two valences, and as C. is a tetrad, each with one exception, which is unsatisfied, is likewise joined to the corresponding element H., thus—



(Phenyl.)

Should the unsatisfied atom of C. become saturated with H., *phenyl hydride*, *benzine* or *benzol* (C_6H_6), is formed. The atoms of H. in phenyl hydride may be displaced by other univalent elements or radicals and substitution compounds constructed : thus should one atom of H. be displaced by hydroxyl (HO), *phenol or carbolic acid* (C_6H_5HO) is produced; should nitroxyl (NO_2) displace an H. atom of phenyl hydride, *nitro-benzine* ($C_6H_5NO_2$) results; if amidogen (NH_2) replace an H. atom, *aniline* ($C_6H_5NH_2$) is formed, and if carboxyl (COHO) take the place of H., the product is *benzoic acid* ($C_6H_5CO.OH$).

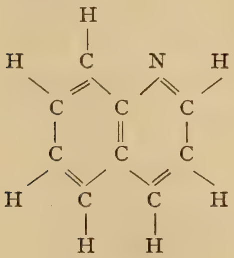
Di-derivatives containing two atoms of the same element or radical, are capable of three isomeric modifications, according as the replaced H. atoms are those numbered 1.2. or 1.3. or 1.4. in the above graphic formula, which isomers take the prefix *ortho-* or *meta-* or *para-* to distinguish them; thus, should hydroxyl displace 2H. atoms in phenyl hydride, one of 3 compounds may result—ortho-oxyphenol (*pyrocatechin*), meta-oxyphenol (*resorcin*), or para-oxyphenol (*hydroquinone*), all of which have the common formula C_6H_4-$(HO)_2$; or should hydroxyl and carboxyl be the replacing radicals, ortho-benzoic acid (*salicylic acid*), meta- or para-benzoic acid may result, the formula for each of which is the same—$C_6H_4HO.COOH$. The carbon chains of the phenyl hydride group may join with similar chains, thus—



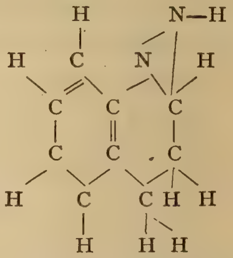
(Naphthaline.)

giving rise to an homologous series, *benzene* (C_6H_6) being a single link, 2 links united forming *naphthaline* ($C_{10}H_8$), 3 links *anthracene* ($C_{14}H_{10}$), etc.

The carbon atoms of phenyl hydride may be replaced by other elements; thus, if the triad N. take the place of a C. atom in the chain, *pyridine* (C_5H_5N) results. The carbon chains of the benzene and pyridine groups may unite with the production of *chinoline* (C_9H_7N),



(Chinoline.)



(Chinocine or Quinocine.)

or by a modification in the arrangement of valences of the pyridine link in chinoline, it is enabled to unite with more H. and N., forming *chinocine* or *quinocine* ($C_9H_{10}N_2$), and from these are obtained several important salts, as *Kairin* (oxyethyl-chinoline hydride hydrochlorate), *thallin* (tetrahydroparamethyloxychinoline) and *antipyrine* (dimethyloxychinocine).

Phenyl hydride, *benzine* or *benzol* is only of interest in medicine from a toxicological point, several cases of poisoning from it having been reported,* and from the fact as shown by Filehne,† that its derivatives, *benzyl-tropine*, *benzyl-quinine*, etc., are local anæsthetics of considerable power.

ACIDUM CARBOLICUM—CARBOLIC ACID.

This substance, termed also *phenol*, *phenic acid*, or *phenyl hydrate*, is a product of the distillation of coal-tar oil.

PREPARATION.—**Crude Carbolic Acid** (*Acidum Carbolicum Crudum*) is made by treating the impure coal-tar of commerce with a saturated solution of potash, when it is resolved, on the addition of water, into a light oil and a heavier alkaline liquid; the latter is separated and neutralized with hydrochloric acid, and the impure carbolic acid, which is disengaged, is afterward distilled from dried calcium, to remove water, when upon exposing the distillate to a low temperature, carbolic acid congeals in the form of a colorless crystalline mass. Recently a pure synthetic phenol has been placed on the market.

CHEMISTRY.—In its *pure state* it is solid at ordinary temperatures, crystallizing in long rhomboidal needles, white or colorless, of a peculiar empyreumatic odor like unto (but not identical with) that of creasote, and an acrid, burning taste; if even slightly impure, it has a reddish color, or will acquire it on exposure. Although it combines with salifiable bases, it does not act as an acid upon colors, and is chemically phenyl hydrate (C_6H_5HO). Its sp. gr. is 1.065; it deliquesces readily and assumes the liquid state in the presence of a little water, without dissolving in it.

When *quite pure* it melts at 160° F., forming an oily-looking, colorless liquid, which boils at 359° F. It is soluble in 20 parts of water, and very soluble in alcohol, ether, acetic acid, glycerin (commercial and absolute) and in the fixed and volatile oils.

TESTS.—Carbolic acid may be recognized by the following

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* *Annales d'Hygiène*, 1883, p. 426, MM. Neumann et Pabst.

† *Berlin Klin. Wochensch.*, No. 7, 1887.

tests: "1st, by its peculiar smell; 2d, by the formation of yellow picric acid, with nitric acid of 36° B.; 3d, by the production of a blue or green color when treated with a small quantity of ammonium hydrate and a trace of a solution of a hypochlorite" (Salkowski's test); "4th, by a lilac color produced on the addition of a small quantity of ferric sulphate; 5th, by a yellowish-white precipitate with bromine water" (Witthaus*).

The last three tests are very delicate. 6th. The most delicate test is that suggested by Pluggé: "When a liquid containing carbolic acid is boiled with a little solution of mercurous nitrate containing a trace of nitrous acid, a reduction of the mercurous salt takes place and the liquid becomes of an intensely red color." This test is said to detect 1 part of carbolic acid in 200,000. Carbolic acid in solution coagulates albumen and precipitates nitrocellulose from collodion, which distinguishes it from creasote.

INCOMPATIBLES.—With the alkalies and alkaline earths carbolates are formed; mixed with bromine a white precipitate goes down. It is also incompatible with antipyrine, collodion and the metallic salts.

AIDS.—Creasote and the phenol derivatives.

PHYSIOLOGICAL EFFECTS.—Carbolic acid is a *protoplasmic poison*, destructive to all forms of life, whether vegetable or animal. *Topically.*—When applied to the skin it produces a white superficial eschar, becoming brownish. When applied in a concentrated form it causes very great local anæsthesia, extending inward for some depth to the tissues with which the acid has not come in contact.

INTERNALLY.—Carbolic acid in medicinal doses produces a rather cooling, sedative effect upon the stomach and it probably enters the blood as an alkaline carbolate. Nervous system: after poisonous doses have been given to animals, there is paralysis of the posterior extremities, extending to the anterior, and finally reflex tetanic convulsion. In man a poisonous quantity produces vertigo, contracted pupils, and stupor with sometimes tremors, never, however, amounting to convulsions, as in the lower animals. The convulsions are probably of spinal origin—certainly not peripheral. The reflex activity is at first increased, then abolished. The nerves and muscles are not paralyzed, but after death they are found to be more readily exhausted than normal. Circulation: the heart is at first depressed, afterwards accelerated (caused by stimulation and exhaustion of the vagi). In slow cases of poisoning, death is produced by diastolic arrest. The arterial pressure is reduced on account of the paralysis of the vaso-motor centre of the cord. Dr. Prudden* has shown that in strong solution it paralyzes, while in weak solution, it renders sluggish the movements of the white corpuscles in frogs. Respiration is affected early in the poisoning, the movements being much increased in frequency but very shallow; this increase is due to stimulation partly of the peripheral vagi and partly of the respiratory centre (Salkowski). Temperature is somewhat reduced. Elimination takes place by all the secretions, especially by the urine, saliva and breath. When a small amount only is taken, it is probably all excreted as an alkaline carbolate; but when the amount is larger, a portion is oxidized in the system and escapes under different forms, especially as oxalic acid in the urine. These products of oxidation generally color the urine dark brown or black, and as this is one of the first signs of poisoning, the urine should always be watched when carbolic acid is being administered or when it is applied to a large surface.

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* *General Med. Chemistry.* By R. A. Witthaus, A. M., M. D.

Toxicology.—Anderson† reports a case in which ʒj of the pure acid killed an adult in twelve hours, with symptoms of acute gastritis; and Hearder‡ one in which a man died in thirty minutes after swallowing ʒj. The external application, too, of carbolic acid has destroyed life.

Post-mortem appearances: after death from a concentrated solution of the acid, hard, white, dry spots surrounded by a circle of inflammation are found on all the mucous membranes, particularly visible about the lips and fauces, with which the acid has come in contact, even as far down as the intestines in some instances. All the viscera are filled with dark, imperfectly-coagulated blood, and sometimes there is fatty degeneration of the liver and kidneys.

Antidotes.—As a chemical antidote in cases of poisoning a saturated solution of calcium saccharate has been recommended. To evacuate the stomach the stomach-pump should be used, since the benumbing influence of the poison hinders the action of emetics.

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* *Amer. Jour. Med. Sci.*, Jan., 1881.

† *The Lancet*, Jan., 1869, p. 179.

‡ *Brit. Med. Jour*, May, 1873, p. 584.

Demulcents should be given, but not oils, as it is soluble in them. By forming salts with the alkalies its poisonous action is to a certain extent neutralized, hence their exhibition is called for. Atropine is the physiological antagonist of carbolic acid; enough should be given to counteract the depressing effect of the acid upon the respiration and circulation, and diluents should be freely administered to aid in its elimination (A. C. Post).

MEDICINAL USES.—Carbolic acid is used *internally* to check *vomiting* where the stomach is irritable and nausea a constant symptom, the dose to be small and taken every 3 or 4 hours; as an antifermentative in *eructations;* as a local intestinal astringent in *chronic diarrhœa;* to destroy the germs of *sarcina ventriculi;* as an anthelmintic against *ascarides* and *tænia solium;* and as an antiseptic in certain zymotic diseases, particularly *small pox*, *typhoid fever*, *scarlatina*, *erysipelas*, *diphtheria*, etc. According to Rothe, this agent seems to lower the fever and lessen the diarrhœa of typhoid. It has also been given internally with some success in *cholera* and *diabetes mellitus*, and combined with iodine in *chronic malarial cachexia* it is highly recommended. Carbolic acid spray is used as an inhalation in *chronic nasal catarrh*, *hay-fever*, *chronic bronchitis*, *whooping-cough*, *phthisis*, *gangrene of the lungs*, etc., with a view of destroying germs, stimulating the mucous membrane to healthy action and to correct the fetor.

BY INJECTION.—Deep-seated injections into the tissues of a two per cent. solution of carbolic acid, as recommended by Hüter, have been practiced with success in *erysipelas* (Aufrecht), *abscesses*, etc., and are thrown into the cavity of joints in *synovitis*, and into *bursæ* in ganglion, etc. Extraordinary care must be taken not to inject the acid into a blood-vessel.

Dr. R. J. Levis has injected pure carbolic acid (the crystals liquefied by heat) ʒss–j into the sac of the tunica vaginalis after evacuating its contents, for the radical cure of *hydrocele*. This treatment is followed at the Out-Patient Surgical Department of the Jefferson College Hospital with almost unvarying success. Dr. S. W. Gross* has collected 90 cases of hydrocele treated by the carbolic-acid method, all of which were successful, though suppuration ensued in three. It is occasionally injected into hemorrhoidal tumors for the cure of *piles*, but it is not altogether a safe remedy, and by enemata into the rectum; (gtt. vj to water Oj), against *thread-worms*.

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* *Med. Times*, April, 1888, p. 384.

External Uses.—As an external application its uses are still more important. In the concentrated form it is employed as a cauterant in *condylomata*, *chancroids*, *lupus*, etc., and to produce local anæsthesia for minor surgical operations as the opening of *abscesses*, *felons*, etc., and in various forms of dilution in cutaneous eruptions of parisitic origin as *tinea circinata*, and *capitis*, *favus*, etc., to the pustules of *acne* in full strength; in the form of ointment as an antipruritic remedy to *pruritus ani* and other parts, to allay the itching of *acute eczema* and *prickly heat* applied as a lotion or with vaseline; as an application in *urticaria* (♏x to glycerin f℥j), and in *erythema;* to relieve the pain and itching of *chilblain;* as a wash to cleanse the parts in *psoriasis* and *phthiriasis*. In *epistaxis* carbolic acid in olive-oil (♏v–x to f℥j) passed through the nostrils will often stop obstinate bleeding.

To check the *fetor of the breath* arising from carious teeth, and as a mouth-wash in *gingivitis* it is of service. Carbolic acid is much employed in the form of aqueous solution or in oil as a dressing to *foul ulcers*, *opened abscesses*, *sinuses*, *fistulæ*, *buboes*, etc., to *compound fractures*, to *burns and scalds*; to *suppurating surfaces* with a view to checking this process and the prevention of *pyemia*, and for its use in coagulating albumen as an hemostatic agent in *hemorrhage*.

In aural therapeutics carbolic solution is employed to cleanse the auditory canal before the introduction of powders as in *otorrhœa* and *myringitis*. A minute portion applied to the hollow of a carious tooth will often alleviate *toothache*. It is one of the local remedies used in *endometritis*, and may be mixed in glycerin and applied upon cotton within the uterus. As a deodorizing-antiseptic agent it has a wide range of usefulness; to this end it may be injected into the vagina in *female gonorrhœa*, to keep clean the glans penis in *balanitis* and to purify the nostrils in *ozæna*. Under the belief that carbolic acid destroys the organic floating germs which produce inflammation and suppuration upon wounded surfaces, washings and dressings with solutions of this acid (1 part to 40 parts of water) have been much employed, as first suggested by Sir J. Lister, of Edinburgh. It is also a most valuable disinfectant.

Administration.—The dose internally is gr. j-ij or, if liquefied by heat, gtt. i-j, in sweetened water or glycerin. For topical purposes it may be dissolved in olive-oil or water, 1 to 10, 20 or 50.

For disinfectant purposes, the CRUDE LIQUID ACID (which contains from 70 to 90 per cent. of carbolic and cresylic acids jointly, with impurities derived from coal-tar) answers very well. Sodium and potassium carbolates have been also employed. *Ointment of carbolic acid* (*unguentum acidi carbolici*) contains 10 per cent. of carbolic acid in ointment.

Sodii sulpho-carbolas (*Sodium sulpho-carbolate*) ($NaC_6H_5SO_4.2H_2O$) is a colorless, transparent salt occurring in rhombic prisms, permanent in the air, soluble in about 5 parts of water, and also in glycerin and alcohol. It is obtained by adding sodium carbonate to a solution of barium sulpho-carbolate, previously obtained by adding barium carbonate to sulpho-carbolic acid (made by dissolving one part of crystallized carbolic acid in an equal amount by weight of strong sulphuric acid—$C_6H_5HO+H_2SO_4=C_6H_5HSO_4+H_2O$), and stirring until effervescence ceases and then filtering.

Potassium, magnesium and calcium sulpho-carbolates have also been employed; they may be given as antiseptics in *cholera* and *zymotic diseases* generally. They are recommended as excellent topical applications to inflamed mucous membranes, and good results have attended their use in *acute tonsillitis*, *aphthœ of children*, *acute nasal catarrh* and *gonorrhœa*. Sodium sulpho-carbolate is a good remedy for *flatulence*; dose, gr. x–xv. The lead sulpho-carbolate might be used where the lead acetate is indicated and the corrective action of carbolic acid is called for, while its solubility in glycerin and alcohol adapt it to external application.

CREASOTUM—CREASOTE.

PREPARATION AND CONSTITUENTS.—Creasote is a complex substance obtained from wood-tar by dry distillation, or from crude pyroligneous acid; the best is made from beechwood-tar. It contains *phenol* (C_6H_5HO), *cresol* ($C_6H_4(CH_3)HO$), *creasol* ($C_8H_{10}O_2$), and *guaiacol*, besides other substances obtained from wood-tar. When pure it is a colorless, oleaginous liquid, with a caustic, burning taste and a penetrating, disagreeable, characteristic odor, like that of smoked meat. Its sp. gr. (U. S. P.) is 1.035–1.085, but when pure is 1.080. After exposure to light for a long period it becomes wine-yellow; if it turn red, it is not fit for medicinal use. It forms two solutions with water, one of 1 part to 80 parts of water, the other of 1 part of water to 10 parts of creasote; and it is soluble, in all proportions, in alcohol, ether, naphtha, and glacial acetic acid.

Tests.—Crude phenol is often substituted for creasote; the latter may be distinguished by its insolubility in commercial glycerin; by not precipitating nitro-cellulose from collodion when mixed with it; by giving a green color with ferric chloride and alcohol (phenol gives a brown color) and by yielding a green color passing to brown with ferric chloride and ammonium hydrate (phenol giving a violet color) (Witthaus).

Incompatibles.—Strong sulphuric and nitric acid decompose it; and it reduces some of the metallic salts as silver nitrate.

Aids.—Phenol and its derivatives.

Effects and Uses.—Creasote possesses *many properties in common* with carbolic acid. A remarkable property of creasote is its power of preserving meat, whence its name (from κρέας, flesh, and σώζω, I save.) It is eliminated by the bronchial mucous membrane (which it stimulates as it passes out, and hence is a good expectorant), by the kidneys, etc. It is not much used because of the difficulty of procuring the pure drug. In large doses it is an acro-narcotic poison, resembling carbolic acid, but with more marked nervous symptoms. In cases of poisoning from creasote the same treatment is to be resorted to as in poisoning by carbolic acid.

In small doses it is styptic and astringent, as it coagulates albumen, and, though not very nearly allied to the vegetable astringent articles that contain tannic acid, it is, perhaps more generally administered for its astringent than for any other properties. It is an excellent remedy in *hematemesis*, and is also employed in *hemopytsis* and other hemorrhages. It is very efficacious in allaying *vomiting*, *eructations* and *gastric irritability*, and has been exhibited for its astringent virtues with good effects in *chronic diarrhœa* and *chronic bronchitis*, and as a nervine in *epilepsy*, *hysteria*, *neuralgia*, etc.

Externally it is applied in various degrees of dilution, to indolent, sloughing and foul *ulcers*. In the concentrated form it is a good styptic in *capillary hemorrhages*, and it is applied with effect to the hollows of carious teeth, for the removal of the pain of *toothache*.

Administration.—Dose, internally, ♏j–iij, frequently repeated, in pill or diluted with mucilage.

For external use, from gtt. ij–vj, or more may be added to f℥j of distilled water.

Aqua Creasoti (*Creasote-Water*) (1 part to distilled water 99 parts). It may be used *locally* as a slightly stimulating lotion, or mixed with poultices to correct fetor. *Internally* it is a convenient form of administration. Dose f℥j–jv.

Nitro-benzine is an important agent in the aniline industries, being used in the manufacture of the latter for commercial purposes. It is not employed in medicine, but is interesting on account of the numerous cases of *poisoning* which have occured from its use in perfumery (in which it is known as the "Essence of Mirbane"), and to impart the flavor and smell of bitter almonds to articles of food or beverages. It has also been taken by mistake for a *liqueur*.* The proper treatment of poisoning by this substance is the prompt evacuation of the contents of the stomach if it has been swallowed, artificial respiration, and blood-letting followed by transfusion.

Aniline is used especially in the manufacture of brilliant dyes. Numerous cases of *poisoning* are on record from the ingestion of confectionery, etc., colored by this means.

The various aniline-colors are used in medicine as reagents in staining bacilli for microscopical examination. It is also interesting as being the base of aniline acetate, from which antifebrin, one of the latest and most powerful antipyretics, is obtained.

ACETANILIDE.

PREPARATION AND CHEMISTRY.—Acetanilide or Antifebrin ($C_6H_5NH.COCH_3$,—not official) is a neutral chemical product, prepared by heating aniline with crystallizable acetic acid in a special receptacle, distilling the product and purifying by successive crystallizations, and consists of aniline acetate from which the elements of water have been separated by a dialytic action at an elevated temperature (Merck).

It is a very stable compound, resisting the action of acids and alkalies at ordinary temperatures, and occurs in the form of a white crystalline powder, odorless, having a slightly sharp, but not dis-

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**Deutsche milit.-Zeitung*, 11, 1873.

agreeable taste, almost insoluble in cold water (1 to 160 parts), but easily soluble in boiling water (1 to 25 parts), alcohol (3½) and ether (6).

Physiological Effects.—The most important effects of this drug are the rapid lowering of febrile temperature and the power which it possesses of moderating the activity of the nerve-centres.

As an antipyretic it is four times more powerful than antipyrine, causing a reduction of temperature within an hour after its administration, the minimum being attained in from three to five hours, followed at first by a slow and then a more rapid rise until the temperature reaches the original height, or even a little beyond it, in from three to twelve hours.* This action is more marked when the temperature is very high,† and when the medicine is so administered that the artificial reduction will take place coincidently with the natural subsidence: thus its effects are greater when given in the morning. More or less profuse perspiration occurs during the reduction of the body-heat, and the succeeding rise is sometimes preceded by a rigor.

From extensive and careful experiments with acetanilide, thallin and antipyrine, Pasternatzky‡ concludes that from five to ten minutes after taking either of these substances, the internal temperature rises, and the heat given off by radiation is increased in direct proportion to the elevation of the cutaneous temperature, although the maximum elevation is attained earlier than the maximum loss of heat, and that the sweating coincides with the latter. During the second hour the internal temperature continues to fall, but with more intensity; the cutaneous temperature gradually subsides, and the loss of heat by radiation and the sweating diminish in direct proportion to the decline of the latter. Therefore, not only do they lower temperature, but they also balance the distribution of caloric in the system. They are antipyretic, by restraining nitrogenous metamorphosis, by limiting heat-production, and also by regulating the heat-distribution of the economy. These effects are only seen in a condition of pyrexia. As the temperature falls the pulse becomes slower and stronger and the arterial tension is heightened. Acetanilide impairs temporarily the oxygen-carrying function of the red corpuscles, by lessening the oxy-hemoglobin and forming with it methy-hemoglobin, as is shown by the cyanosis which is sometimes observed, but this condition quickly passes away as the normal condition of the blood is restored.

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* *Centralbl. f. Klin. Med.*, No. 33, p. 1561. Cahn und Hepp.

† *Deutsche Med. Wochensch.*, No. 16, 1887.

‡ *Vratch*, No. 2, p. 21; No. 4, p. 70, 1887.

Gastric or intestinal disturbance is of rare occurrence, while renal irritation never results, although the amount of urine is sometimes considerably augumented; and lastly the elimination of urea is diminished.*

In decided doses, acetanilide lowers the activity of the reflex centres, and reduces the conductivity of the motor and sensory nerves, probably to a great extent through its influence on the blood.† An inclination to sleep accompanies this analgesic action.

Toxicology.—If given in lethal doses ‡ (gr. v–x per kilo. of weight of animal), the effects are manifested primarily upon the constituents of the blood and then on the nervous system; afterward general prostration with stupor ensues and the temperature is rapidly and progressively lowered. Sensation is first diminished and then lost; the animal sinks into a comatose condition, followed by spasmodic convulsions, and dies in from 24 to 36 hours. The heart is at first accelerated then slowed, and the respiratory functions are markedly and progressively depressed.

Medicinal Uses.—Acetanilide is chiefly used as an *antipyretic* and *anodyne.* For the former purpose it used to be more generally employed than any other agent of this group, although some observers § regard antipyrine as safer, fearing the cyanosis tendency to collapse, and severe rigors which occasionally attend the action of acetanilide.

In all cases of high temperature, notably in *typhoid fever*, *phthisis*, *scarlatina*, and *rheumatism*, it may be given in small doses, repeated as required, with excellent effect.

In *acute rheumatism* it not only reduces the temperature, but also is said to act on the joints in as favorable a manner as do the salicylates. In *croupous pneumonia*, and in *chronic catarrhal pneumonia*, it has been prescribed with advantage.

It is used as an anodyne in the pains of the various nervous diseases, especially those of *locomotor ataxia*; also in *neuralgia*, particularly of the fifth pair of cranial nerves; in *headaches* of various kinds not depending on indigestion, and in *dysmenorrhœa*.

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* *Russ. Meditz.*, No. 43, 1886, p. 728. A. Berezovski.

† *Comptes Rendus de la Soc. de Biol.*, Juillet, 1ième, 1887. M. Lépine. *Rev. Méd. de la Suisse Romande*, Juin, 1887. M. Demiéville.

‡ *Bull. Gén. de Thérap.*, Fev. 28ième, 1887. Dr. Weill.

§ *Comptes Rendus de l'Acad. des Sciences*, Avril 18ième, 1887. Germain Sée.

In *epilepsy* it diminishes the violence and frequency of the *petit mal*, but does not seem to influence the *grand mal*.

ADMINISTRATION.—The dose of acetanilide ranges from gr. jv–viij, though much larger quantities have been taken with safety. It is best administered in capsules or in powder, as it diffuses readily into the blood in spite of its insolubility.

EXALGINE.—(METHYLACETANILIDE).

PREPARATION AND CHEMISTRY.—Exalgine (not official) from ἐξ, without, and ἄλγος, pain, discovered by Hoffman in 1874, and quite recently introduced, is obtained by heating methylaniline with acetyl chloride and purifying the product by successive crystallization in pure alcohol and water. It occurs in long, white, fine crystals, tasteless and odorless, slightly soluble in water, but dissolving readily in alcohol pure or diluted. It is, theoretically, of complex structure as follows: for 2 of the H's of aniline $C_6H_5N\left|\begin{matrix}H\\H\end{matrix}\right.$ there are substituted 2 different molecules, one, acetyl (C_2H_3O), the other methyl (CH_3), hence the formula $CH_3C_2H_3OC_6H_5N$, and the name methylacetanilide.

INCOMPATIBLES.—It reduces, dissolved in dilute alcohol, potassium permanganate; with the iodides, iodine is liberated, and liquor potassæ, a precipitate, is formed.

AIDS.—Its analgesic and antipyretic effects are increased by the agents of this class, as antipyrine and salol; also in the first named range by belladonna, opium and cocaine. Insoluble remedies like salol and antipyrine may be taken in the same capsule.

PHYSIOLOGICAL EFFECTS.—These have been carefully investigated by Gandineau,* who found that in man a dose of gr. jv–vj produces no phenomena, except perhaps a slight buzzing within the ears. When injected under the skin of mammals, clonic convulsions, accelerated breathing and salivation are produced accompanied by lowering of temperature. Lethal quantities, about gr. vj per 2¼ lbs. of the animal's weight, destroy life by collapse, the blood being found dark colored through reduction of the oxyhemoglobin. It benumbs the parts of the tongue to which it may be applied. Exalgine affects profoundly the cerebro-spinal axis, full doses producing trembling, anxiety, loss of sensibility, and motor-power, the tactile sense persisting, until life terminates by respiratory paralysis. But little alteration of arterial pressure and cardiac action has been noted. It is only by the exhibition of a quantity sufficient to bring about its full action that benefit is to be derived from its use. Caution, however, must be enjoined with this new remedy, as lethal effects have been produced with medicinal doses.

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* *Bull. Gén. de Thérap.*, 1889, p. 207; also *Lancet*, London, vol. ii, 1891, p. 950.

MEDICINAL USES.—This new medicament, by reason of its peculiar property of diminishing sensibility, should be adapted to the treatment of *neuralgia*, *sciatica*, *lumbago*, and to allay the fugacious pains of *locomotor ataxia*.* It is not to be understood, however, as supplanting the old and well-tried remedies, but rather as a new-comer under trial. It has to a certain extent, been employed with success as an analgesic, in cases of *neuralgia*, *migraine*, and *torticollis* in the dose of gr. j-vj per diem. Lowenthal † reports fair results in 35 cases of *chorea* treated with exalgine, the dose being gr. iij t. d.

ADMINISTRATION.—The dose varies from gr. vj-x in 24 hours. As exalgine is but slightly soluble in water it may be administered either in elixir or capsule.

ACIDUM BENZOICUM—BENZOIC ACID

PREPARATION AND DESCRIPTION.—Benzoic Acid ($HC_7H_5O_2$) is obtained from benzoin by sublimation, or by the action of alkalies; it is also made in Germany from hippuric acid. As obtained by sublimation, it occurs in white, soft, feathery hexagonal crystals, of a silky lustre, and not pulverulent. It has more or less of the agreeable odor of the balsams, a warm, acrid and acidulous taste, is inflammable, sparingly soluble in cold water, rather soluble in boiling water, but perfectly soluble in alcohol, alkaline solutions and fixed oils. It is a constituent of the *balsams*.

INCOMPATIBLES.—With the alkaline salts, as those of potassium, sodium, etc.

AIDS.—Borax and boric acid.

EFFECTS AND USES.—Benzoic acid is a *local* irritant, destroying minute organisms, possessing decided antiseptic properties, and acting on the general system as a stimulant, with a particular direction to the mucous surfaces. In large doses it increases the action of the circulatory and respiratory apparatus, and is said to be a more powerful antipyretic than salicylic acid. It stimulates the cutaneous and bronchial secretions, and increases the acidity of the urine. In its passage through the system it is partly decomposed, passing out with the urine in the form of hippuric and benzoic acids, during which it plays the part of a mild antiseptic as well as acidifying the urine, hence its value in the treatment of *ammoniacal urine*, *pyelonephritis*, and in *cystitis* and *irritable bladder*, when accompanied by alkalinity and phosphatic deposits. It has been used in diphtheria, erysipelas, etc., with a view to its antiseptic effects, and as an expectorant in chronic bronchial affections. *Locally*, it is employed as a dressing for *wounds*, *ulcers*, etc., and to prevent animal fats from becoming rancid.

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* *Bull, Gén. de Thérap.*, Fevrier, 1890, p. 214.

† *Berliner Klinische Wochen.*, Feb. 1st, 1891.

ADMINISTRATION.—Dose, gr. v-xx; if in pill soap should be the excipient.

Sodii Benzoas (*Sodium Benzoate*) ($NaC_7H_5O_2H_2O$) is a white amorphous powder, freely soluble in water, which effloresces on exposure to the air, and has a faint odor of benzoin and a sweetish, astringent taste. It has been *prescribed* as a substitute for salicylic acid, being less powerful as an antipyretic, but is a safer remedy. It has been *used* extensively in *phthisis*, with a view to its antiseptic qualities; also in *diphtheria*, *scarlet fever* and the *eruptive fevers* generally, *whooping-cough*, etc.; and in *acute rheumatism* as an antipyretic. From ℥j-iij may be given in twenty-four hours.

Ammonii Benzoas (*Ammonium Benzoate*) ($NH_4C_7H_5O_2$) is made by adding water of ammonia to an aqueous solution of benzoic acid, and occurs in the form of minute white, shining, thin, four-sided laminar crystals, with a slight odor of benzoic acid and a bitterish, saline, somewhat balsamic taste and slightly acrid but persistent after-taste. It is soluble in water and alcohol, and, when heated, sublimates without residue. It is *incompatible* with the ferric salts.

This salt, when taken *internally*, is probably decomposed by the gastric acids, and produces the constitutional effects of benzoic acid, for which it may be substituted; the ammonia renders it stimulant and antacid, and acceptable to irritable stomachs. It is an excellent remedy for *incontinence of urine* due to the irritation produced by an alkaline condition of that fluid, and is used with advantage in *irritable bladder* whenever the urine is alkaline and loaded with phosphates. Dose, gr. v–xx.

RESORCIN.

Resorcin (not official), chemically meta-oxyphenol, derives its name from having been first obtained from certain resins by the action of alkalies, and from bearing some resemblance to orcin.

Description.—It occurs as shining tabular crystals, having a slightly phenol-like odor and a sharp-sweetish taste, soluble in most liquids, especially in water.

Physiological Effects.—*Locally* it is an *antifermentative* and *antiputrefactive* agent, destroying the organisms on which these processes depend. *Internally*, like other agents of this group, resorcin promptly reduces febrile temperature when administered in medicinal doses, but it does not seem to affect the temperature of healthy individuals, as Dr. Justus Andeer, experimenting upon himself, took as much as 10 grammes without observing a reduction of body-heat.

The antipyretic action is more marked in typhoid fever, pneumonia and erysipelas than in other febrile states, although it is present to some extent in malaria, and indeed it appears to possess some antiperiodic power, as might be inferred *a priori* from the close chemical relationship which it bears to quinine, to which, however, it is very far inferior in this respect. It is well borne by the stomach. The decrease in the temperature of fever is usually preceded by transient vertigo, tinnitus aurium, flushing of the face, headache and oppression in the chest. As the temperature declines there is nearly always a profuse perspiration, and the pulse and respiration, which were at first accelerated, are markedly slowed. This occurs in about one hour after the ingestion of the drug and continues for from two to four hours, and is then followed by a more or less well-marked chill and a gradual rise in temperature. Elimination takes place rapidly, chiefly through the urine.

Toxicology.—When a large dose is given to an animal, trembling supervenes, soon followed by general epileptiform convulsions, each occupying a few minutes only, which regularly increase in severity, reach their maximum and as regularly decline. The general sensibility is not affected. The convulsions appear to be of spinal origin. The pulse is weak, rapid, and irregular, the breathing accelerated, convulsive, then shallow and weak, and finally death takes place from failure of respiration, preceded by a rise in temperature from excessive muscular action.

Medicinal Uses.—As an antipyretic resorcin has been used in *typhoid fever*, *pneumonia*, *erysipelas*, *acute rheumatism*, and *septicemia*. It has also been given in *malaria*, especially in the intermittent form, and is said to diminish recent splenic tumefaction, and to antagonize the *malarial cachexia* (Righi*). As a sedative and antifermentative it is used in *acute gastro-intestinal catarrh*, *gastrodynia* and *dyspepsia* due to the fermentation of the ingesta, for which purpose it may be advantageously combined with sodium bicarbonate.

Locally it has been applied as an antiseptic to unhealthy *ulcers* and *wounds*, and to destroy *fetor* and promote healthy granulations. Unna recommends a 5 or 10 per cent. ointment in *phthiriasis capitis*, *squamous eczema* of the head and in *seborrhœal eczema*. In *psoriasis* an ointment of the strength of 10 to 20 per cent. may be used with advantage. The powder or a strong ointment may be applied in parasitic *sycosis* with marked benefit†.

According to Dr. Jackson‡, it is very useful in epitheliomatous lesions where surgical interference is contraindicated, as it exerts a powerful absorptive effect on new cell-infiltrations. Pure resorcin has also been powdered on *condylomata* of the penis, vulva or anus with brilliant results§. It is also used in solution of various strengths in various diseases of the mucous membranes, as in *acute* or *chronic conjunctivitis*; as a disinfectant, antiseptic, and in strong solutions, as a caustic in laryngeal diseases. In *tubercular ulceration of the larynx*, the pain soon subsides and the cough diminishes after these applications.

In *gleet* a 2 per cent. solution may be injected into the urethra with excellent effect (Dr. Justus Andeer||, Righi, *op. cit.*).

Administration.—The ordinary dose is gr. v–xv, either in capsules or in solution in alcohol, glycerin or water, disguised with syrup of orange-peel. These doses may be repeated every four hours. Much larger amounts have been taken without producing

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* *El Siglo Médico*, Mar. 9, 1884.

† *Centralbl. f. die ges. Therap.*, Mar. 1886, Ihle.

‡ *Journ. Cutan. and Genit.-Urin. Diseases*, Vol. V, Nos. 6 and 7.

§ *Russ. Meditz.*, No. 38, 1886, p. 639, Gatchovsky.

|| *Centralbl. f. die gesammte Therap.*, Apr. 1884.

injurious or alarming symptoms. For topical application it may be made up with vaseline, 5 to 20 per cent.; or dissolved in water.

Hydroquinone or Hydrochinone (para-oxyphenol) and *Pyrocatechin* (ortho-oxyphenol), neither of which are official, are isomers of resorcin, as has already been pointed out. Their *effects* are *identical* with those of the latter, than which they are about four times as powerful. They are little *used*, being superseded by acetanilide and other antipyretics of more recent date, although, by some, hydroquinone* is thought to be among the most powerful and least harmful remedies of this group.

ACIDUM SALICYLICUM—SALICYLIC ACID.

This acid although known for nearly half a century as a derivative of *salicin* (see p. 161) has been employed only since 1875 as an article of the Materia Medica.

PREPARATION.—It has been prepared from the flowers of *Spiræa ulmaria* or *Meadow-Sweet*, and from the *oil of gaultheria* (where it exists as methyl salicylate), and by the oxidation of salicin. It is now made by combining pure carbolic acid with caustic soda, and treating this compound with dry carbonic acid under the influence of a gradually-increasing heat, when one-half of the carbolic acid distils over, while the other half, into the molecule of which carbonic acid enters, remains behind as sodium salicylate; from a hot aqueous solution of this, saturated with hydrochloric acid, salicylic acid ($C_6H_4\left\{\begin{smallmatrix}OH\\COOH\end{smallmatrix}\right\}$) is obtained in the form of minute, broken, acicular crystals (having usually the appearance of a pale-pinkish granular powder), which are bleached with great difficulty.

CHEMISTRY AND TEST.—It is odorless and nearly tasteless, having, however, a sweet and astringent after-taste, with slight acridity in the fauces. It is practically insoluble in cold water, but quite soluble in boiling water, a hot aqueous solution retaining when cold, in proportion to its coldness, 1 part in from 250 to 500 parts of the solution. The addition of two parts of sodium sulphite, or 1 part of ammonium phosphate, or three parts of sodium phosphate, renders it much more soluble in water. It is freely soluble in alcohol, ether and glycerin. *Test.*—Dissolved in water, a fine violet color is produced on the addition of ferric chloride.

INCOMPATIBLES.—The ferric salts, alkalies, and mineral acids.

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* *Berliner Klin. Wochensch.*, No. 29, 1884, Dr. P. Seifert.

Aids.—Antiseptics, antipyretics, and cardiac depressants.

Physiological Effects.—In its effects salicylic acid is *allied* to carbolic acid, possessing probably greater powers as an antiseptic in arresting the putrefactive and fermentative processes, while it is devoid of smell or notable taste, is not volatile, and is also, in quantities necessary for effective action, free from irritant or poisonous influence. When given *internally* in full medicinal doses buzzing and roaring in the ears, with fulness in the head are experienced, which are much increased after the administration of larger doses, amounting even to deafness and partial blindness. If an excessive dose be taken all the symptoms are intensified, and great restlessness followed by delirium, involuntary evacuations, stupor, and in the lower animals convulsions, are observed. The action of salicylic acid upon the ear (as well as the similar action of quinine) has been investigated with varying results. Kirchner concludes that these remedies produce intense congestion of the tympanum and labyrinth (due to vaso-motor disturbance), which may lead to changes in the nerve-filaments; while Weber-Liel and Guder* found anemia of these parts as the result of the ingestion of the drug.

The heart-beat is first increased in frequency, but afterward slowed; excessive doses cause the pulse to become slow and labored. The blood-pressure is at first elevated (from the action of the acid on the heart and on the vaso-motor centres), then lowered. Blood: Prudden,† from experiments upon frogs, verified on rabbits and on the human blood, concludes that salicylic acid restrains the migration, and in strong solutions is inimical to the life, in weak solutions to the activity, of the white blood corpuscles. Respiration is at first quicker and deeper than normal from the action of the drug on the vagi and to some extent on the respiratory centre; later it becomes slow and labored, and death results from asphyxia. Temperature: non-toxic doses have little or no effect upon the normal temperature; in fever, however, salicylic acid causes a marked reduction in the body-heat which lasts several hours. Secretion: full doses cause free diaphoresis which is sometimes exhausting. The urinary flow is augmented and the proportion of urea, uric and phosphoric acids in the urine, increased. It somewhat favors the secretion of milk, and the amount of sugar in that secretion seems to be heightened*. Gastro-intestinal tract: large amounts cause nausea and often vomiting. Absorption and elimination: it is probably absorbed as a sodium salicylate, and is discharged by the urine mostly unchanged, though partly as salicyluric acid and salicin. Elimination takes place slowly, though it appears in the urine 15 minutes after being taken. After the ingestion of large quantities the urine will be colored green from an increase of the indican. Whether employed internally or externally a portion passes into the urine unchanged and gives with ferric chloride a blue or violet reaction. The acid retains its antiseptic properties only so long as it remains in the free state.

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* *Med. Record*, Oct. 28th, 1882.

† *Am. Jour. Med. Sci.*, LXXXII, 1882.

Medicinal Uses.—For its *antipyretic* effects salicylic acid has been used in fevers with varying success. In *acute rheumatism*, especially in robust patients, it is preëminently of value, reducing the temperature, relieving the joint-affection and ameliorating the pain; but whether it shortens the duration and decreases the frequency of cardiac complications and relapses is still disputed. In rheumatic hyperpyrexia it is of value, but it should not be relied on to the exclusion of other means of reducing temperature. In *gonorrhœal rheumatism* and *gout*, where no kidney complication exists, it is also of service, and it has been used in *typhoid* and the *eruptive fevers*, *pyemia*, *puerperal fever*, *dengue*, *muscular rheumatism*, *diphtheria*, etc.; although not as effective in these diseases as in rheumatism, and, indeed, it has been condemned by some as being of no avail. It is serviceable in *acute tonsillitis* in doses of gr. x every two to four hours.† As an *antizymotic* to prevent fermentation of the ingesta its use is advised in *gastric catarrh*, *gastric dilatation*, *sarcina* and allied complaints. As an *anthelmintic* salicylic acid has been prescribed with success against *tape-worm*, and is also internally and locally used against *ascarides*. *Externally* it has been applied in the moist stages of *eczema* and *eczema rubrum* with good results, and in the form of ointment to *tinea versicolor*.

As a detergent and desiccant it may be sprinkled dry on *wounds* or *ulcers* in the form of powder, or mixed in various proportions with some inert powder, as starch; or a solution, 1 part to 300 parts of water, may be used as a substitute for the antiseptic carbolic dressing; the stronger solution with sodium phosphate, 1 part to 50 parts of water, is used to wash or spray *foul surfaces*, or as an application in *diphtheria*; a solution of gr. j to f℥j of water is a good injection in *gonorrhœa* and collyrium in *conjunctivitis*.

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* *Deutsches Arch. f. Klin. Med.*, Jan., 1882; Dr. Max Stumpf; also *Bull. Gén. de Thérap.*, Fèvrier, 1889, p. 119.

† *Brit. Med. Jour.*, Oct. 14th, 1882, Dr. Edward Mackey.

ADMINISTRATION.—Dose, gr. x–ʒj. The following solution makes an excellent application to inflamed or *painful corns*. ℞ Acidi salicylici, gr. x; collodii flexilis, fʒj. M.

Sodii Salicylas (*Sodium Salicylate*) ($2NaC_7H_5O_3.H_2O$) is a white crystalline powder, without smell, having a sweetish, alkaline taste.

Internally its effects and uses are *identical* with those of salicylic acid, to which it is preferred, because it is more soluble in water, and causes less gastric irritation.

Dr. Gasparini* employs it in *pleurisy* when diaphoretic treatment is indicated.

Locally it is recommended in solution (sodium salicylate, ʒij; laudanum, fʒij; water, f℥viij) to relieve the suffering caused by *gouty hands and feet*, and *rheumatic joints*†.

Dr. Baudon anoints the surface three times a day, in *variola*, with sodium salicylate, ʒj; in cold cream, ℥j, and claims that it lessens the suppuration and removes the odor.

Lithii Salicylas (*Lithium Salicylate*) is also official, and is used internally to fulfill the indications of salicylic acid. The salts are given in doses corresponding to those of the acid.

SALOL.

Salol (not official) is an ether-combination of salicylic acid, 60 per cent., and carbolic acid, 40 per cent. It is not a salicylate of phenol as has been erroneously stated in some quarters, but a salicylic-phenol-ether, and occurs as a white, tasteless powder, having a faint odor resembling carbolic acid, slightly unctuous to the touch, insoluble in water, but easily soluble in alcohol, in ether and in the fixed and volatile oils.

PHYSIOLOGICAL EFFECTS.—It is an *antiseptic*, not a germicide, for, like iodoform, it will prevent the formation of bacteria, but does not destroy them when actually present (Neneki). *Locally*, as it is insoluble, it does not irritate the skin nor the surface of wounds when applied to them, and hence may well replace iodoform in local antisepsis. When administered *internally*, it reduces *febrile temperature*, but has no influence over that of health. This antipyretic action is very marked, occurs suddenly fifteen minutes after salol has been taken, and is to a certain extent independent of the amount administered ;[*] that is to say repeated doses will not lower a temperature already reduced by a single dose, although they will maintain the reduction. Simultaneously with the decline of the fever, sweating occurs, as in the case of the other agents of this group, but it is not marked, nor do the chilly sensations which sometimes precede the rise of temperature ever amount to a distinct chill[†]. The circulation is but little influenced, even by large doses of salol (Lombard *loc. cit.*) but the respirations increase rapidly, so much so, that at the expiration of ten minutes after taking the medicine, they have doubled in frequency, at the same time becoming very shallow, and although they are soon slowed yet some time elapses before they return to their normal depth. Salol also possesses *analgesic* properties in common with other antipyretics of the aromatic series of carbon-compounds, but this subject has as yet not been sufficiently investigated, to warrant a positive statement regarding its cause.

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* *Gaz. Med. Ital.*, Lombard, March, 1885.

† *Brit. Med. Jour.*, Oct. 14, 1882, Dr. E. Mackey.

When salol is taken with food, it is said to pass unchanged and undissolved through the stomach into the duodenum, where under the action of the pancreatic juice, it is converted into carbolic and salicylic acids ; hence it will act as an intestinal antiseptic without affecting the stomach. It is said, too, to render the bile more fluid. No *toxic* symptoms have been observed, and it is believed to be innocuous. It is eliminated principally through the kidneys, under the form of salicyluric acid and phenol-ether-sulphuric acid, the latter imparting the dark color to the urine, although during a course of salol, the urine assumes a dark hue similar to that seen when large amounts of carbolic acid are taken.

MEDICINAL USES.—Salol has been much used in *acute rheumatism* to lower the temperature and relieve the pain, and although it does this most promptly, its effects are much more evanescent than are those of sodium salicylate. It neither prevents relapses nor lessens the tendency to cardiac complications. It has also been prescribed in small doses to lower the temperature in *phthisis* (gr. j–iij every few hours), and it is recommended in *typhoid fever* and *pneumonia* for a similar purpose.

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[*] *Bull. Gén. de Thérap.*, 15ième, 1887, Dr. Lombard.

[†] *Deutch. Med. Wochenschr.*, No. 19, 1887, Dr. Herrlich.

It has been found very serviceable in *intestinal catarrh*, especially when the upper part of the tube is affected; thus in catarrh of the duodenum it is of special value, as it is there that it is re-converted into its constituent parts. As it tends to liquefy the bile, it is also recommended in *catarrhal jaundice*, in cases of occlusion of the bile-ducts from inspissated bile. Salol in obstinate *diarrhœa** when the stools are unusually fetid, by reason of its antiputrefactive properties, often renders valuable aid, particularly when combined with suitable dietetic treatment, and under its influence they lose their fetor and regain their normal consistence.

Prof. von Nencki and others recommend it in the treatment of *acute cystitis*, since it has been found to entirely prevent the decomposition of urine when mixed with it; and since its component parts are eliminated unchanged by the kidneys, a similar effect probably follows its internal administration.

Like many of the antipyretics, it possesses the property, when administered internally (gr. iij–x, t. d.), of relieving the pains of *locomotor ataxia*, *neuritis*, *nervous headache* and *neuralgia* to a remarkable degree, and it also exerts a similar, though less marked influence, over *lumbago*, *myalgia* and other *muscular pains*.

Locally it has been used as an antiseptic in the dressing of *wounds*, *ulcers* and other surgical affections; and, as it does not appear to be toxic, and is to a great extent free from disagreeable odor, it would seem to be an excellent substitute for iodoform.

Administration.—Salol may be given in capsules, pills, powder or in solution in alcohol or in oil. The dose ranges from gr. v–ʒ j. As an antipyretic the average dose is gr. xv–xxx, and as much as ʒij–iij have been administered in twenty-four hours without deleterious effects. It may be applied to *burns*, salol 1 part, olive-oil and lime-water each 60 parts: as an antiseptic powder equal parts of salol and starch well pulverized.

NAPHTHALINE.

Naphthaline (not official), when pure, occurs as thin, white, shining, rhombic crystals, having a strong, pungent odor and a burning taste, insoluble in water, diluted acids or alkalies, but dissolving in alcohol, ether and oils.[*]

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* *Bull. Gén. de Thérap.*, t. ii., 1891, Égasse.

It was introduced into medicine as an expectorant, and stimulating application,[†] but was first used as an antiseptic by Dr. E. Fischer,[‡] in 1881, who recommended it as cheap, innocuous, and as efficacious as carbolic acid.

PHYSIOLOGICAL EFFECTS.—Naphthaline is a *disinfectant, deodorant, antifermentative* and *antiseptic* agent, whether applied *locally* or administered *internally*. It has no *antipyretic* action. It does not irritate the stomach—in fact, it is believed to pass unchanged through that organ into the intestines, and there to act as an antiseptic, rendering the stools inodorous, or imparting to them its own odor to a slight degree. Although very insoluble, it is to some extent absorbed, and eliminated by the lungs and kidneys, imparting a dark color to the urine (Binz), and in large doses irritating the kidneys, and even in some cases causing violent cystitis, with strangury.[§] In medicinal doses, it retards or prevents the decomposition of the urine, and hence is of value in cystitis. It is not toxic, probably because of its insolubility.

MEDICINAL USES.—It is chiefly used *internally*[||] as an antiseptic in the treatment of gastro-intestinal and renal and cystic disorders.

In *dyspepsia* due to fermentation of food; in *acute gastro-intestinal catarrh* (combined with opium); in *chronic gastro-intestinal catarrh*, to prevent fermentation and the consequent nausea, heartburn and eructations, it is highly recommended.

In *acute diarrhœa* and in *dysentery* it has also proved of use, but would appear to act more beneficially when combined with an evacuant plan of treatment than when given alone.

It is also recommended in *typhoid fever* as an intestinal antiseptic. In *pyelonephritis, cystitis acute or chronic, chronic prostatitis* with retention and decomposition of urine, and in cases of old strictures with multiple fistulæ and ammoniacal urine, in doses of gr. xx, it is said rapidly to render the urine sweet, either limpid, neutral or acid in reaction, while it causes the pus to diminish or disappear altogether from that fluid.

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[*] *Wienner Med. Blätter*, No. 28, 1885, Binz.

[†] *Journ. de Pharm. et de Chim.*, 1842, Dupasquier.

[‡] *Berlin. klin. Wochensch.*, XIX, 1882, p. 113–116.

[§] *Ibid.*, No. 42, 1884, Rossbach.

[||] Cf. Binz. op. cit.

It has also been successfully used to cause the expulsion of parasites from the alimentary canal, and may be administered for this purpose to children in cases of *round or thread-worms* in doses of gr. j–iij, t. d., or to adults with *tænia*, in gr. xx–lxxx daily in divided doses (Koriander).

It is also recommended as an expectorant.

Locally naphthaline has been much lauded as a substitute for iodoform in the antiseptic treatment of *wounds*, *abscesses* and *ulcers*, either venereal or common; and it has been used as a surgical dressing after surgical operations, and even after amputations, but does not appear to possess any special advantage over the stronger antiseptics (as corrosive sublimate) when carefully used.

Administration.—Dose, gr. ss–viij to an adult. As much as gr. lxxx have been given without unpleasant results in twenty-four hours, but as cases of cystitis and strangury are sometimes produced, it is best to be cautious in administering naphthaline to a person unaccustomed to the drug.

It is best administered in compressed pills or in capsules.

Locally, it may be used either in the form of powder, ethereal solutions (ʒss–j in ether f℥ss) or ointment with vaseline.

The peculiar and disagreeable odor of naphthaline may be altered and even rendered pleasant by trituration with a small quantity of the oil of bergamot.*

NAPHTHOL.

This substance ($C_{10}H_7O$, not official) is *beta* or *iso*-naphthol, and is derived from naphthaline. It occurs in the form of white crystals of carbolic odor, almost insoluble in water, but miscible in alcohol, ether, chloroform, and most of the oils.

Incompatibles.—With subacetate of lead it forms a white creamy precipitate. Though practically insoluble in water, its alcoholic solution may safely be diluted 50 per cent. with water.

Aids.—Topically by creasote and carbolic acid.

Contraindications.—As it is eliminated by the kidneys, making the urine turbid and sometimes albuminous, it should not be administered when the renal apparatus does not perform its functions normally.

Physiological Effects. —*Locally*, it is quickly absorbed; when applied to the delicate tissues in aqueous solution (gr. ij to f℥)

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* *Am. Druggist*, Jan., 1885, p. 17.

it sets up a temporary sense of irritation and burning, but if dissolved in a fatty substance (10 or 20 to 100) and rubbed on the healthy skin no irritation is provoked. When applied too freely it may become absorbed to the extent of inducing toxic effects, as vomiting, convulsions and hematuria. Beta-naphthol in weak solution prevents completely the development of various kinds of microbes, as those of yeast, the micrococci of pneumonia and of suppuration; and it retards the growth of the bacilli of typhoid fever and tuberculosis. It prevents the decomposition of the urine, and organic substances in full putrefaction cease to putrefy when brought in contact with it. Within the stomach about ℥vj½ to a man weighing 145 lbs. induce decided phenomena of intoxication, while toxic symptoms begin to come on when the quantity reaches ℥iij, whether introduced by rectal injection or the stomach. Compared with *a* naphthol it is more than ½ less toxic, but possesses ¼ weaker germicidal powers. Naphthol readily destroys canine life.

MEDICINAL USES.—Naphthol, by reason of its germicidal virtues, is adapted to the treatment of cutaneous parasitic diseases. In the management of *favus* and *prurigo*, either as a soap (2½ per cent.), or pomade (5 per cent.), applied alternately with sulphur-soap and friction at night, Kaposi praises this medicament highly; while against *scabies* one day's treatment with frictions, the same observer found sufficient to effect a cure in a large number of cases. It is also applicable to the treatment of *tinea versicolor* and *circinata*. In *psoriasis* it is less efficacious than chrysarobin. Naphthol has been employed, too, to assist the cicatrization of *chancroids* and *ulcers*.

ADMINISTRATION.—But little experience has been recorded with this remedy for internal use; it has, however, been given gr. 25 to 40 in the 24 hours in capsule, as an antiseptic agent in *typhoid fever*. For local use a pomade, 10 parts of naphthol to vaseline 100; and an alcoholic solution, 20 to 40 of the remedy to 100 of fluid, are employed. Caution is enjoined with this remedy.*

Pyridine (not official) is a clear, colorless, volatile liquid, with a strong, somewhat aromatic odor, and a burning taste; having a sp. gr. 0.98; boiling at 240.8° F. and being readily miscible with water, alcohol, ether, benzine and the fixed oils, the resulting solutions being clear and, in case of the watery solution, of an exceedingly alkaline reaction.

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* On Naphthol, see Égasse's article *Bull. Gén. de Thérap.*, 1891, t. 120, p. 399.

Physiological Effects.—When the vapor is inhaled by the lower animals the inherent irritability of the respiratory centre is greatly diminished, and the act of breathing becomes less frequent.[*] When inhaled by man, less air is respired in a given period; indeed the feeling of need of air is diminished, while the respiratory curve in a healthy individual shows expiratory dyspnœa. The respiration becomes less frequent, irregular, somewhat periodic, and sometimes long intervals of apnœa are observed. After the inhalation, the breathing remains for some time less frequent and less full, with occasional deep inspirations. There is always abundant salivation, coryza, and increase of bronchial mucus, and sleep often supervenes. As the same effects (excepting the decreased need of air, sleep and increase of bronchial secretion) are observed when the nostrils are irritated by a faradaic current, Dr. Silva[†] believes that pyridine acts on the respiratory centre chiefly through the trigemini, but to some extent also by the vagi. According to De Renzi[‡] it is well borne by the stomach in doses of gtt. vj–xxv in water, and notably increases the force, while diminishing the frequency of the cardiac systole. The arterial pressure is raised. It has very slight antipyretic properties.[§]

Medicinal Uses.—It was first recommended as an inhalation, by Prof. Sée, in *asthma*. For this purpose f℥j may be poured on a plate placed in a small room or closet, in which the patient remains for twenty or thirty minutes at a time, thrice daily. This treatment lessens the dyspnœa rapidly in all forms of asthma, and is free from dangerous consequences,[‖] as pyridine is rapidly absorbed and as rapidly eliminated by the urine.

In *angina pectoris* it is said to act very favorably and rapidly.[¶] According to De Renzi its action much resembles that of digitalis, for which it may often be substituted with advantage, as its effects are more rapidly produced, and, being rapidly eliminated, its action is not cumulative.

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[*] *Bull. Gén. de Thérap.*, Juin 30ième, Drs. Germain Sée, et Bochefontaine.

[†] *Gazz. delle Cliniche*, June, 1886.

[‡] *Riv. Clin. e Térap.*, No. 3, 1887.

[§] *Vratch*, No. 21, 1882. Dr. K. K. Sakovski.

[‖] *N. Y. Med. J.*, Mar. 13, 1886. Dr. Jos. Neff. *Der Fortschritt*, No. 1, Jan. 5, 1887. Dr. Wyss.

[¶] A monograph, "*De la Pyridine et de la Collidine comme médicaments respiratoires.*" Par le Docteur Dandien, Paris, 1886; Dr. Wyss, *op. cit.;* De Renzi, *op. cit.*

Chinoline (not official) is now manufactured synthetically in a pure state from aniline or nitro-benzol by the action of glycerin in the presence of a dehydrating agent by the process of Skraup, but was first obtained from coal tar by Runge and afterwards by Gerhardt and by Vyshnegradski from the cinchona alkaloids by decomposition. When pure it is an oily, colorless liquid with an aromatic odor, which combines readily with acids, forming salts of which the tartrate only is not deliquescent.

PHYSIOLOGICAL EFFECTS.—Chinoline is *antiseptic* and *antipyretic*, differing but little in its effects from other agents of this group. Simultaneously with the lowering of the temperature diaphoresis occurs, which is sometimes profuse. This is preceded by a period of excitement, flushing of the face, accelerated cardiac action and elevated arterial tension, and is followed by a diminution in the frequency of the heart-beat and respiration. According to Dr. N. Sudeikin* besides lowering the temperature, it acts chiefly on the nerve-centres, especially those of the spinal cord and medulla oblongata, paralyzing their reflex activity. It depresses, and in large doses paralyzes the respiratory centres and the excito-motor cardiac nerves. The hope, at one time entertained, that in this remedy the long-sought substitute for quinine had at length been found, has been doomed to disappointment, though it is undoubtedly a powerful antipyretic and to some extent an antiseptic.

MEDICINAL USES.—It has been used to lower the temperature in *typhoid fever*, *acute rheumatism*, and *erysipelas*. In pneumonia and malarial fevers it is decidedly inferior to other agents, and in phthisis it is not to be recommended.

The more recent antipyretics are preferable, as from the comparative smallness of dose they can be more readily handled and are not so apt to cause profound depression.

ADMINISTRATION.—The pure drug may be given hypodermically in solution in olive-oil (1 to 2) which is said not to cause irritation or inflammation, or the tartrate may be exhibited internally in solution—dose gr. vij–xv.

Kairine (not official) is a pale buff-colored powder, slightly soluble in water, having a bitter, disagreeable taste.

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* *Vratch*, Nos. 21, 29 and 30, 1882.

Physiological Effects.—It was first investigated physiologically, by Prof. Filehne, of Erlangen,* who recommended it highly as an antipyretic, for which purpose it was largely used for several years in the treatment of numerous diseases accompanied by high febrile temperature. Of late, however, it has been superseded as an antipyretic by antipyrine, acetanilide and other more recent, and probably, less dangerous members of this group of medicines. In brief, its action is as follows: †

It is a blood-poison acting on the red-corpuscles, destroying the hemoglobin with the formation of methemoglobin,‡ and partly destroying the plasma. The febrile temperature is rapidly reduced to the normal, the fall being accompanied by profuse sweating; but after a short time the temperature again rises, preceding which rigors sometimes occur. The reflex centres of the cord are depressed and finally paralyzed if a large amount has been taken. The cardiac action is at first slowed (from depression of the excito-motor cardiac ganglia, and probably also from irritation of the inhibitory cardiac ganglia), but is afterwards accelerated (from excitation of the central ends of the accelerator fibres of the vagi), and finally in fatal cases, paralysis of the motor-cardiac ganglia, and arrest of cardiac contractions ensues, the cavities of the heart being greatly distended. Respiration is slowed, and, when lethal amounts are taken, ceases from paralysis of that centre before the heart stops beating. Paresis, and finally complete paralysis of central origin results. The peripheral endings of the sensory nerves are at first excited, then paralyzed. When kairine is administered hypodermically local anæsthesia is always produced around the seat of the injection.

Kairine is rapidly excreted and the lesions of the tissues and of the blood are not lasting, the animal recovering, even if symptoms of dangerous collapse are present, when the medicine is removed from the system either by the urine or by venesection. It is eliminated chiefly by the urine, which is of a dark green color during its passage from the system. Cyanosis is often observed.

The conclusion arrived at by Beyer,§ which the editor endorses, is that "the distinctive influence it exerts on the red blood-corpuscles" "and the weakening effect upon the heart, render its employment objectionable and dangerous."

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* *Berlin. Klin. Wochensch.*, No. 45, 1882, und No. 6, 1883.

† *St. Petersburg Inaug. Dissert*, 1885. Dr. M. K. Popoff; also *Meditz. Oberz.*, Fasc. 4, 1884, p. 406. Dr. L. M. Popoff.

‡ *Meditz. Oberz.*, Fasc. 9, 1884, p. 928. L. Morokhovez.

§ *Am. J. Med. Sci.*, Apr., 1886, p. 382. H. G. Beyer, M. D., M. R. C. S., U. S. Navy.

ADMINISTRATION.—Dose, gr. iij–xxx. The average quantity required in fevers is gr. viij–xv, repeated hourly until the temperature falls, when the dose is to be decreased. It may be given in capsules or wafers.

Thalline (not official) is a synthetically prepared alkaloid belonging to this series, being chemically tetrahydroparamethyloxychinoline. The sulphate is the salt most generally in use, although the tartrate and hydrochlorate have also been employed. Thalline sulphate is a light buff-colored powder, with a sharp, strongly bitter taste, and a slight phenol-like odor. The salts are all readily soluble in water.

PHYSIOLOGICAL EFFECTS.—*Locally*, thalline is an *antiseptic* and *antifermentative* agent. *Internally*, it lowers the temperature of fever, but exerts little or no effect on that of health. The cutaneous vessels dilate, and while the internal temperature is lowered, that of the surface is elevated until they nearly correspond, and at the same time there is an increased radiation of heat from the surface,* with diaphoresis, which, however, is not as great as that produced by kairine. As an antipyretic it acts rapidly, but the effect passes away in 4 or 5 hours, a more or less distinct rigor occurring, usually not severe, followed by a return of the fever. The pulse and respiration are both diminished in frequency, and the arterial tension is at first elevated, afterward depressed.† According to Beyer (*op. cit.*) when injected into the blood of frogs and turtles, small doses temporarily increase the heart-rate, but slightly diminish the work done by it; in larger doses there is a decrease both of the cardiac rate and work, especially the latter; very large doses cause diastolic arrest, five times as much being required as when kairine is used. The respiratory capacity of the blood after the administration of thalline, was measured by Maragliano and found to be reduced.

Ehrlich ‡ found that when given in excessive doses (to animals) for some time it collects in large quantities in the adipose tissues, being absorbed with great avidity by the oil-drops, and given up slowly, unchanged, to the blood. Given in this way, he finds that thalline causes, 1st. Adipose degenerations, particularly affecting the heart and the renal tubules, probably due to the deoxydizing influence of the drug. 2d. "Vascular necrosis," affecting especially the region of the salivary glands and slight similar changes in the pancreas; and 3d. Papillary infarction of the kidney, hemorrhagic in character. He found death was preceded by muscular tremors, tetanus, and ptyalism, but was always able to arrest a fatal termination by administering oxygenated oil of turpentine as an antidote to the poison. He has never found large doses, in practice, to have had a bad effect, although he has given as much as 10 to 15 grammes a day. A number of cases of severe rigors have, however, been observed by others, and symptoms of collapse have followed its use. Thalline is eliminated chiefly by the urine, to which it imparts a dark green color, and in which it can be detected from ½ to 1 hour after being taken.* According to some observers † it decreases the quantity of the urine passed, while increasing its specific gravity. The elimination of carbonic acid is reduced one-half, and the amount of urea excreted one-third (Maragliano).

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* *Vratch*, No. 2; 4; 1887. Pasternatzky.

† *Gazz. degli ospitali*, July 5, 1885. Maragliano.

‡ *Deutsche Med. Wochensch.*, No. 48, 1886.

Medicinal Uses.—Thalline, although probably not preferable to either acetanilide or antipyrine, is an *antipyretic* which promises more than either hydroquinone or kairine, and is certainly much safer than the latter. It has been used in *typhoid fever*, *pneumonia*, *pleurisy*, *diphtheria*, *measles*, *erysipelas*, and other affections characterized by high fever; but, like other antipyretics, while lowering the temperature, it exerts little if any influence on the course of the disease. It would seem to have but little effect in rheumatism or in malarial fevers. In phthisis it should be given with caution, as it is apt to weaken the patient by tending to increase the colliquative sweats (Landenberger), while in debilitated subjects, no matter what the disease, care should also be taken for fear of collapse, which is particularly apt to occur when the drug is administered to such patients.‡ It is usually well borne by the stomach.

Britneff and others recommend a single daily dose of gr. xij–xvj, thus obtaining a more intense and prolonged antipyretic effect, and only producing one sweat and rigor per day. On the other hand, Ehrlich recommends in typhoid fever, small doses (gr. j–iij) repeated hourly and rapidly increased until a complete condition of apyrexia is produced, which is then to be maintained by the repetition of the maximum dose, either until from the symptoms it is probable that the disease has run its course, or until the height of the fever is past, when he substitutes the hydropathic treatment for thalline.

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* *Wien. Meditz.*, *Wochensch.*, No. 48, 1884. Von Jaksch; Maragliano, *op. cit.*

† *Russ. Meditz.*, No. 1, 1886, p. 6. Britneff.

‡ *Russ. Meditz.*, No. 14, 1886, p. 240. Britneff.

As an unirritating antiseptic injection thalline sulpahte may be used in *gonorrhœa,* dissolved in water.

ADMINISTRATION.—Dose, gr.jv–xvj in pills or capsules, repeated whenever the temperature tends to rise.

ANTIPYRINE.

Antipyrine (not official), a synthetically prepared alkaloid which combines readily with acids, forming salts, is a whitish crystalline powder, very soluble in water, with a sweetish bitter taste.

IMCOMPATIBLES.—Spirit of nitrous ether or nitrous acid forms isonitroso-antipyrine; decoctions, tinctures and infusions containing cincho-tannic acid are precipitated by antipyrine. With strong solution of chloral a globular oleaginous precipitate goes down; ferric chloride forms a blood-red color. Most of the metallic salts form precipitates or colors with this agent.

PHYSIOLOGICAL EFFECTS.—*Locally* it is *antiseptic* and *antifermentative.* The internal action of antipyrine is *very similar* to that of other antipyretic remedies. According to Pasternatzki,[*] it rapidly reduces the temperature in the febrile state, acting as do acetanilide and thalline (q. v.) by diminishing nitrogenous metamorphosis (thus decreasing heat-production), and by regulating heat-distribution (thus increasing heat-radiation), but Beyer[†] found as the result of his carefully conducted experiments that this antipyretic action was due entirely to increased heat-radiation caused by the extensive dilatation of the veins and capillaries which this remedy induces. The perspiration which accompanies the decline of temperature may be very profuse, but after the period of apyrexia, which lasts from four to twelve hours or even longer, the return of fever, although sometimes ushered in by a chill, is much less apt to be characterized by a severe rigor and even collapse than is the case with kairin or thalline. Antipyrine increases to some extent "the power of contraction of both auricles and ventricles" (Beyer), and hence is a cardiac tonic. It elevates the arterial pressure to a slight degree.

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[*] *Op. cit.*

[†] *Am. J. M. Sci.,* Apr., 1886, p. 402.

In medicinal doses it does not affect the constitution of the blood. Like many other antipyretics it depresses the reflexes and is analgesic. It is excreted chiefly by the kidneys and may be detected in the urine for two or three days after its administration has been suspended.* Occasionally antipyrine causes a cutaneous eruption to appear, usually erythematous but sometimes papular or vesicular.

MEDICINAL USES.—Antipyrine is used, as its name implies, as an *antipyretic*, and *analgesic* agent. For the former purpose it is probably more generally employed at present than any other remedy. In *typhoid fever*, when the temperature is high, antipyrine is of the greatest value, but it possesses no more power over the disease-process than do the other remedies already discussed. In *tuberculosis*, gr. xv at the onset of the fever, repeated if necessary, will be found efficacious, and in *acute rheumatism* numerous observers attest to its good effects, not only in lowering the temperature, but also in relieving the pain. It does not, however, lessen the danger of cardiac complications, nor the liability to relapse. In *sunstroke* with high temperature it acts most beneficently. It has also been advantageously administered in *erysipelas*, *pneumonia*, the various exanthemata, and *surgical fever*. It is not an antiperiodic, and although it may be used to moderate the fever of *malarial affections*, it will not prevent the return of the paroxysm. It is prescribed, too, in *hay-fever* and *influenza*.

As an analgesic it is a valuable addition to our armamentarium. For the purpose of palliating the pain of *muscular rheumatism*, *lumbago*, *neuralgia* of the superficies, of preventing an attack of *asthma*, in fact as a succedaneum of morphine, Dr. A. Wolff † finds, as the result of numerous experiments, in the subcutaneous injection of antipyrine, an efficient and quickly-acting remedy, and one which is not succeeded by inflammation at the seat of introduction. The "lightning pains" of *locomotor ataxia* are often promptly relieved by doses of gr. x-xv repeated as necessary, and various neuralgic affections, as *sciatica*, *tic-douloureux*, *headache*, and other nervous conditions characterized by pain (Germain See) are often cured by its timely administration. In *muscular rheumatism* and *myalgia* it has, too, been used with good results.

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* *Rev. de Thérap.*, Mai 15, 1887. Prof. Germain Sée.

† *Therapeutische Monats.*, No. 6, 1888; quoted.

Antipyrine in doses of gr. x-xv will often allay the pain in the first stages of *labor* without apparently interfering with the process of dilatation of the os uteri.

Administration.—Dose, gr. v–ʒj. The average dose as an *antipyretic* is gr. xv–xxx repeated; as an *analgesic* gr. x–xv repeated in from one to four hours if necessary. It may be administered either in aqueous solution or in capsules, or as it is readily soluble, by hypodermic injection.

Many of the *essential oils* as well as the *camphors* obtained from them have proved to be antiseptic. Among these may be mentioned the *oils of cloves, gaultheria, peppermint* and *thyme* (q. v.). *Menthol,* too (*v.* p. 232), derived from the oil of peppermint is a local anæsthetic as well as antiseptic, and has been considered under the head of *aromatics,* but *thymol* (*see* p. 535), deserves a more extended notice as an antiseptic.

IODOFORMUM—IODOFORM.

Preparation and Description.—Iodoform is obtained by the action of chlorinated lime upon a heated alcoholic solution of potassium iodide, which yields calcium iodate and iodoform, the latter being separated by the solvent action of boiling alcohol. It is formyl teriodide (CHI_3), and occurs in the form of small, scaly, yellow crystals, having a persistent saffron-like odor and sweet taste, insoluble in water, but soluble in alcohol, ether, chloroform, and the fixed and volatile oils. Its molecule contains rather more than 95 per cent. of iodine.

Incompatibles.—With corrosive sublimate.

Physiological Effects.—*Topically,* it acts as a *germicide, anæsthetic* and *deodorant* without irritating the tissues. According to Dr. G. Rómmo,* Mikhail, P. Polïakoff, and others, the effects of iodoform *internally* are as follows: Nervous system; in warm-blooded animals, iodoform at first lowers the functional activity of the nerve-centres; voluntary motion is next affected and finally abolished (especially in frogs); anæsthesia is present to some extent, and the reflex functions of the cord are depressed; the excitability of the nerve-trunks to external stimulation is lessened, as is also muscular contractility. A period ensues, if a sufficiently large dose has been taken, during which there is excitation of the nerve-centres, with clonic and tonic contractions of the muscles. Circulation: the capillaries in the web of the frog's foot at first dilate but afterward contract. In mammals, a moderate dose primarily retards and strengthens the pulse, at the same time slightly elevating the arterial pressure from the stimulation of the cardio-inhibitory centre: under full doses, the pulse becomes markedly slower and feebler, and the blood-pressure falls. Larger doses at first cause slowing of the pulse, which, however, becomes quick and irregular, from paralysis of the cardiac centre, but this is soon followed by secondary retardation and final arrest in diastole, from paralysis of the cardiac muscle. Respiration and temperature: moderate doses cause a rise in the temperature from 1.8° to 2.7° (in dogs); larger doses produce a marked fall of temperature (7.2° to 9° F.) and convulsive respiratory movements. Gastro-intestinal tract: full doses cause vomiting and diarrhœa (in dogs). Secretion: it increases the salivary, biliary, and intestinal flow. Elimination: it is discharged unchanged in small quantities by the lungs, but principally leaves the system as alkaline sodium iodate, in the urine, which can be found one hour after iodoform has been administered and may be present for three days.

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* *Arch. de Physiol.*, 1883.

Toxicology.—When an excessive dose has been taken, elimination is checked, albumen and blood appear in the urine, glomerulo-nephritis and fatty degeneration of the liver, heart and other organs occur, and an inflammation of the spinal cord, with results similar to acute polio-myelitis, is found. Numerous deaths have been reported* from its use as an antiseptic dressing. According to Schede and to Küster the symptoms of poisoning may be divided into six classes: 1. In this class of cases high fever is the only symptom. 2. Fever with gastro-intestinal irritation, rapid pulse, and depressed spirits; recovery is the rule. 3. Very rapid, compressible pulse, but no fever; a very dangerous form. 4. Very rapid pulse and very high fever; few recover. 5. Great depression, collapse, and death; seen especially after severe operations. 6. Cerebral symptoms, resembling meningitis.

Antidotes.—The best preventive to poisoning by iodoform consists in remembering that its absorption, even when used externally, is much more rapid than its elimination. Accordingly, should symptoms of poisoning occur, withdraw every particle of the adherent dressing, sustain the system with stimulants and opium, and give large doses of potassium bicarbonate (Behring*).

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* *La France Méd.*, Nos. 30, et 31, 1882.

MEDICINAL USES.—Iodoform, in the United States, is seldom prescribed for internal use. In Europe Bozzolo, following Moleschott,† recommends it highly in *diabetes mellitus.* He finds that the elimination of sugar and the amount of urine are diminished and the blood-pressure lowered by the daily use of gr. xv–xxx. In the therapy, however of glycosuria,‡ drugs play a secondary part as compared with dietetics. From its action on the circulation it is recommended by Moleschott, Testa, and others, in *valvular diseases* where the hypertrophy is not compensatory. In these affections, given in doses of gr. ¼, five or six times a day, it lessens the dyspnœa and œdema and increases the urine, the heart beats more regularly, and the tendency to hemoptysis disappears. But it is not comparable in therapeutic efficiency in cardiac affections to digitalis. Numerous observers speak highly of its use in *phthisis* as increasing the body-weight and appetite, diminishing the cough, expectoration and night-sweats and slightly lowering the temperature. It is of more value in the early than in the later stages of this disease. As an anthelmintic, it has been used for the destruction of *tænia* and of *ascarides*, but observers differ as to its value in these affections. In the form of *vapor* it is said to possess anæsthetic properties, inferior, however, to those of chloroform.

EXTERNALLY.—It is a local anæsthetic and antiseptic, and for this end has been found a good application to *chancres, balanitis* and *irritable ulcers, bed-sores,* etc.; it is used also to relieve the pain of *cancers,* and for these purposes it may be dusted over the ulcerated surface, which is then to be dressed with glycerin spread upon lint, and it may be powdered over the surface of *foul-smelling ulcers,* to allay their odor. A saturated solution of iodoform in chloroform is serviceable in relieving the pain of *neuralgia* and *gout;* an iodoform suppository is also useful in painful diseases of the rectum and bladder, as *hemorrhoids* and *acute cystitis.* Altschul recommends iodoform as the most efficacious application for *burns* of the second and third degree; he prefers either an iodoform-gelatin of the strength of 10 per cent., or better still, an iodoform-paste prepared as follows: ℞ White wax, ʒss; olei olivæ, fʒj; liquoris plumbi subacetatis, fʒjv; iodoform, ℥ij-iv. M. As an antiseptic Mikulicz * found iodoform to be equal to carbolic acid, and less apt to produce constitutional disturbance from absorption. As a dressing to open wounds, as *bubo* and *fistula*, he found it would check profuse discharge, prevent decomposition, and stimulate healthy granulations. Into suppurating tracts it may be packed with sterilized cotton. In treating deep wounds he recommends a pencil composed of iodoform, 1 part, with oil of theobroma, 2 parts. The smell can be overcome by adding oil of bergamot ♏j, to iodoform gr. x. In *septic*, *gangrenous*, or *sloughing wounds* it forms an excellent antiseptic dressing, and is very useful in *chronic* or *irritable leg-ulcers*. Rómmo (*op. cit.*) found it more efficacious in preventing the appearance of bacteria than in arresting their multiplication. Burman speaks highly of a solution of iodoform, ʒj, to collodion, f℥x, painted well beyond the line of redness in *erysipelas;* and Dr. Tschalovoski has seen excellent results follow the application of the powder to *smallpox pustules*, to prevent pitting during the stage of suppuration. In *ophthalmia*, in the membranous forms of *conjunctivitis*, and as an antiseptic in ophthalmic surgery, the pure drug, finely powdered, is highly recommended. Bougies made with iodoform in glycerin and gum-acacia, have been passed into the uterine cavity (previously washed out with carbolized water) in *puerperal fever* and allowed to dissolve when septicemia was feared; and it has been used as an injection in *acute gonorrhœa* in the proportion of ʒv to carbolic acid, gr. jss, glycerin f℥ijss, and water f℥ss. Only one injection should be used per diem for three or four days, after which it may be used twice daily. In *otorrhœa*, with much suppuration, iodoform applied by insufflation to the auditory canal, previously cleansed and dried, and retained with a cotton-plug, gives excellent results. Theobroma-bougies of iodoform are used in *gonorrhœa.*

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* *Deutsche Med. Wochensch.*, Jan., 1883.

† *Wien. Med. Wochen.*, Nov., 1882.

‡ See Ralfe's *Diseases of the Kidneys* for diet suitable to diabetics.

Administration.—Dose, gr. j-iij, three times a day, in pill, but much larger doses have been given without producing untoward effect. The *ointment* consists of iodoform, 10 parts, rubbed up with benzoinated lard, 90 parts.

ARISTOL.

The researches for a chemical substance endowed with antiseptic properties analogous to those already in use, but not presenting the inconveniences incident to their employment, has led to the discovery of a definite body to which Eichoff has given the fantastic name of *aristol*,* (not official), from *άριστος* meaning superior.

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* *Wiener Med. Wochenschrift*, 1881.

Preparation and Description.—Wilgeroth and Vortman obtained it by adding to powdered iodine a solution of thymol in an aqueous ammoniacal mixture of alcohol, which yielded an oily precipitate, and the distillation of the vapor in acetic acid and crystallization gave thymol moniodide, that is, one atom of iodine had replaced one atom of hydrogen in thymol. By further treatment with iodine the moniodide was made to take up an additional atom of iodine and aristol or dithymol iodide ($C_{10}H_{12}HIO_2$) resulted. It is an amorphous reddish-brown powder, inodorless, insoluble in cold water and glycerin, slightly miscible in alcohol, more so in ether and chloroform, and completely blends with the fixed oils, as vaseline.

Incompatibles.—Aristol is not an entirely stable body since it parts readily with its iodine under the influence of moisture and light, passing to the moniodide, hence it should be preserved in yellow vials, and prescribed alone, though it mixes well with tannic and gallic acids. It is incompatible with the carbonates, starch and corrosive sublimate.

Physiological Effects.—The action of aristol has not yet been investigated and for the present we must be content to know little beyond the fact that while it exerts a destructive influence upon certain bacteria, not including the bacillus anthrax, it is neither toxic nor irritant when applied to wounds. Upon dogs the subcutaneous injection of an oily solution is not poisonous even to the extent of gr. 45 per 2¼ lbs. of body-weight. Introduced within the economy it is eliminated in part at least by the urine under the form of an alkaline iodide though only about half the quantity injected passes out by this channel, and none at all as thymol. The points of injection do not become the seat of inflammation.

Medicinal Uses.—Aristol has been scarcely exhibited internally. It is rather as a local succedaneum of iodoform that it has been brought to notice, over which it possesses the advantage of being odorless, unirritating and harmless. Those who have used it laud it highly as an antiseptic and cicatrant in the treatment of *ulcers* and *cancers*. It has been applied to such an intractable affection as *lupus* with benefit, care being taken to first snip off the tuberculous ulceration. A number of cases, too, of its successful employment in *otorrhœa* with much suppuration are reported, the auditory canal being cleansed previous to the introduction of the remedy: this should be done by insufflation, and the medicament retained with a cotton-wad. The same method of treatment in *chronic nasal catarrh* with scanty and stagnant secretions has given good results. But it is not adapted to acute nasal catarrh, the nasal mucous membrane not well tolerating the drug. It has been also employed to aid the cicatrization of *epithelioma*. Rather more experience and statistics will be required, however, to assign to this new remedy its proper therapeutical place.

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* *Bull. Gén. de Thérap.*, Égasse, 1890.

ADMINISTRATION.—*Topically*, in ethereal solution 1 to 10 of fluid; with collodium, 1 to 9; a pomade 1 part to olive-oil 2 parts, and lanolin 7; in suppository gr. 15 to cacao-butter q. s.

IODOL.

PREPARATION AND DESCRIPTION.—Iodol (not official) is obtained by the action of iodine on pyrol (C_4H_4NH) a constituent of animal oils,[*] in which iodol or tetra-iodo-pyrol (C_4I_4NH) is formed by the substitution of 4 atoms of iodine for 4 atoms of hydrogen. It is a "light-yellowish-gray, fine and specifically light powder," soluble in 5000 parts of water, in 3 parts of alcohol, and in about its own weight of ether. The addition of water to the alcoholic solution causes a milky precipitate. It is very rich in iodine, containing 88.9 per cent. It has very little taste, and is free from disagreeable odor.

PHYSIOLOGICAL EFFECTS.—When in contact with the tissues and secretions of the body iodine is readily liberated, but no constitutional phenomena have attended its long-continued use as an external application.[†] Introduced within the stomach it gives rise to phenomena similar to those of iodoform, though less toxic. It is slightly caustic, adhering readily and uniformly to the surface of a wound, and forming a gray protective film to the granulations underneath. It is said to aid the process of cicatrization.[‡] Its antiseptic power against the microbes of suppuration described by Fournioux, which is due to the liberation of iodine, is about equal to that of iodoform, to which it is preferable from its comparative freedom from nauseous smell and taste and the absence of toxic symptoms attending its external use. Even when applied freely to wounds of extended surface with much loss of substance, according to Égasse,* although dissolved by the secretions and absorbed, no symptoms of poisoning have been observed, as is so often the case with iodoform.† Whether used locally, or administered internally, its presence can shortly be detected in the saliva and urine.

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[*] *Lancet*, Nov., 1885, p. 1013.

[†] *Practitioner*, May, 1887, p. 336. R. N. Wolfenden.

[‡] *Bull. Gén. de Thérap.*, Fev., 1887. Dr. Juquer.

Medicinal Uses.—As an *external* application it has been extensively used in the treatment of *chancres*, suppurating *buboes*, and also in simple *indolent ulcers* with good results, and in no case has any erysipelatous or diphtheritic inflammation been observed. Dr. Petersen, of St. Petersburg, however, applying it as a dusting powder to *chancroids* three or four times daily, observed that usually about the third day the granulations became flabby, "as if hyaline," and that the granulation-process was retarded. Iodol has been much lauded as a substitute for iodoform in *ophthalmic practice*, particularly in the chronic forms of *conjunctivitis* and in sluggish *corneal ulcers*,‡ but it is contraindicated in affections of acute irritative character. According to Katzaüroff, iodol always caused much more irritation than iodoform, when the powder was applied to a healthy eye, and it did not prove as useful in his hands, except in *phlyctenular conjunctivitis*, *trachoma* and *opacities of the cornea*, in which it was of great service.

In *nasal*, *laryngeal* and *pharyngeal affections* it is highly recommended, particularly in *laryngeal phthisis*, in which it is often of signal value (R. N. Wolfenden). *Internally*, it has been used as a substitute for iodoform.

Administration.—Dose, gr. ½–ij, in capsule, pill or solution. *Locally* to the eye or throat, it is used in powder or in alcoholic solution diluted with glycerin (iodol 1 part, alcohol 16 parts, glycerin 34 parts), and to wounds in powder, solution, ointment (1 or 2 per cent.), bougies, wool or gauze.

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* *Bull. Gén. de Thérap.*, t. 2, 1890, p. 443.

† *Compt. Rend. Soc. de Biol.*, Paris, 1890, sér. 9, p. 406.

‡ *L'Union Méd.*, Mars 22d, 1886; *Annales d' Oculist*, Mai, Juin, Juillet et Août, 1886. Dr. Trousseau.

THYMOL.

Preparation and Description.—Thymol ($C_{10}H_{13}HO$), called also cymylic phenol, is a solid crystalline stearopten found in the volatile oil (*oleum thymi*) distilled from thymus vulgaris (*vide* p. 233). It is separated by fractional distillation; that portion of the oil which distils above 392° F. is agitated with a concentrated solution of caustic soda, and the thymol liberated from the resulting solution by hydrochloric acid. It is purified by rectification, and occurs as large, colorless, rhombohedral crystals, having an aromatic odor and a hot, aromatic taste; slightly soluble in water, but very soluble in ether and alcohol.

Effects and Uses.—Thymol is a powerful *antiseptic*. Its effects are analogous to carbolic acid, and like that agent, when *locally* applied it produces paralysis of the cutaneous end-organs of the sensory nerves (Lewin). When given *internally* in full doses it produces tinnitus aurium, deafness, reduction of temperature, often diarrhœa, and sometimes nausea and vomiting. In several cases its ingestion caused violent delirium and collapse; profuse diaphoresis took place, and the urine was of a dark green color, but free from albumen; the sweating was not as marked as that produced by salicylic acid, nor was the antipyretic effect as great. As an antiseptic in inflammations and ulcerations of the mouth, as *stomatitis*, it is very useful, and it has been been employed as an inhalation (gr. vji to warm water f℥j) to diminish the expectoration of *phthisis*, etc. It is one of the best intestinal antiseptics and may be used in amounts varying from gr. v–x internally in abnormal conditions of the intestine attended with putrefactive changes in the chyme. It is recommended by Bufalini in *diabetes mellitus* in conjunction with the exclusive proteid diet of diabetic patients to prevent the gastro-intestinal disturbance which commonly ensues sooner or later upon the withdrawal of the carbohydrates, as well as to prevent or remove when present, the symptoms due to acetonemia. *Locally* it is used to fulfil the same indications as carbolic acid. Da Costa recommends crystallized thymol as a gargle in *diphtheria*. Dose, gr. j–x; as a spray, 1 to 800 of warm water.

ICTHYOL.

This substance (not official) first described in 1882 by Schroetter, and only recently introduced to the profession, derives its name from *ιχθος*, fish and *ολειον*, oil.

PREPARATION AND DESCRIPTION.—Its chemistry and action have been carefully described by Égasse[*] and Charles.[†] It is procured by the dry distillation of a kind of sulphurated bituminous mineral found in the Tyrol, which contains fossil-fish, and marine animal remains in abundance. By this process an oily substance is obtained, which yields on rectification a greenish fluorescent body containing about 2½ per cent. of sulphur, which when treated with H_2SO_4 and neutralized furnishes a new product. This product combines readily with the alkalies, as well as zinc, mercury, etc. With ammonia it forms an icthyolate, or *icthyol*, a thick, fluid, stable, fatty-looking substance, of a brownish-black color, and of a strongly bituminous taste and smell, readily miscible with oils, (except olive), vaseline, chloroform, or ether and alcohol mixed, but only slightly so in ether, or alcohol alone. It is soluble in water though a resinous deposit goes down on standing.

INCOMPATIBLES.—On account of its reducing properties, it should not be mixed with remedies that part readily with oxygen, as potassium permanganate.

AIDS.—Boric acid, salol, and the tarry preparations.

PHYSIOLOGICAL EFFECTS.—The action of icthyol has not yet been completely studied. When given to dogs, in small quantities (ʒj½) it is innocuous, but in doses of from ℥iij–jv, it induces prolonged diarrhœa, hence it may be considered in lethal amounts as a gastro-intestinal irritant. As to whether it exerts any influence upon the cerebro-spinal system and temperature, no observations have been recorded. In feeble doses, it manifests a decided contracting influence upon the calibre of the arteries, veins and capillaries due, according to Unna, but denied by others, to its property of withdrawing oxygen from the tissues when brought in contact with them, by which the external coat of the vessel is kreatinized, and not to a narrowing of its calibre. In large amounts it is stated to bring about an abundant migration of the white corpuscles from the vessels. Some recent experiments by Fessler, show that icthyol possesses antiseptic properties, at least against certain kinds of microbes; moreover its power of abstracting oxygen from the tissues should place it among the agents that hinder the development of aerial pathological germs.

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[*] *Bull. Gén. de Thérap.*, 1891, p. 49.

[†] *Lancet, London,* Sept. 26, 1891.

Medicinal Uses.—So far the employment of icthyol, has been almost entirely limited, as a weak antiseptic, to external exhibition particularly in dermal therapeutics, as *erythema*, *acne*, *eczema*, and *herpes zoster*. It has however, been prescribed topically in *neuralgia* of the 5th pair of nerves, and to *sprains* and *chilblain*. In *erythema* its employment is advised when there is much hyperemia in the form of soap and hot water or perhaps ointment, and the same measures are suitable to *acne* used with friction. A 3 per cent. solution in a mixture of alcohol and ether, is employed in *neuralgia* to be applied with a brush. The form of eczema, which it seems best suited to is *eczema rubrum;* for the ordinary acute eczema it is not adapted. In spite of the favorable reports obtained by some practitioners with this remedy it must be admitted that it is still on trial, and that frequently disappointment will follow the result of its exhibition.

Administration.—For internal use the dose varies for adults from gr. viij to ʒj, in 24 hours given in capsule; for local use it may be made up with lanolin or vaseline, ʒ2½ to the ℥ or stronger; or it may be dissolved in a mixture of alcohol and ether.

DERMATOL.

This recent addition to the materia medica, introduced by Heintz, is bismuth gallate (not official). It occurs as a fine, odorless, saffron-colored powder, unaffected by light or air, and is insoluble in the ordinary menstrua.

Effects and Uses.—Antiseptic virtues are claimed for this medicament which are, however, weaker than those of iodoform, and it is stated to be astringent and unirritating, and to possess absorbent powers. It is not toxic. Dermatol is said to hasten the cicatrization of *ulcers* and *chancroids*, and satisfactory results are stated to have followed its use as a deodorizing-antiseptic application to *balanitis*, *suppurating buboes* and *acute eczema*. It is a good dust-powder in *moist eczema*.

Administration.—Never internally. Topically in powder, or dermatol 10, lanolin 20, and vaseline 70 parts; it mixes well with zinc oxide, and starch.

CARBO LIGNI—CHARCOAL.

Although not strictly ranking with antiseptics, the medicinal uses of charcoal may, perhaps, be appropriately noticed under this head.

Preparation and Description.—Charcoal is prepared by the exposure of wood to a red heat without access of air. For medicinal purposes the charcoal prepared from young willow shoots for the manufacture of gunpowder is preferred. It is a black, shining, brittle, porous substance, without odor or taste, and insoluble in water.

EFFECTS AND USES.—It is not absorbed from the intestinal tract, being discharged with the feces without action upon the economy. It is employed *internally* as an absorbent of acrid secretions and gases, in *dyspepsia* (in which it is often very useful), *eructations*, in *gastric irritation*, *diarrhœa* and *dysentery*.

ADMINISTRATION.—Dose, from one to four teaspoonsful. *Externally* it is used with effect to absorb the offensive gases given off from foul sores, in the form of poultice (*vide* poultices), mixed with flaxseed meal, or with bread-crumb, which is better from its porosity; dry charcoal is sprinkled with advantage over *sloughing ulcers*, and it appears to promote the separation of the sloughs.

ORDER III.—IRRITANTS.

Irritants are medicines which are employed to produce irritation or inflammation of the parts to which they are applied. They may be subdivided into RUBEFACIENTS, EPISPASTICS, SUPPURANTS, and ESCHAROTICS. *Rubefacients* are used merely to produce redness of the skin. *Epispastics*, *Vesicants*, or *Blisters*, cause the transudation of a serous fluid under the cuticle. *Suppurants* produce a crop of pustules. *Escharotics* exert a chemical action on the tissues with which they are placed in contact, and decompose or destroy them.

RUBEFACIENTS.

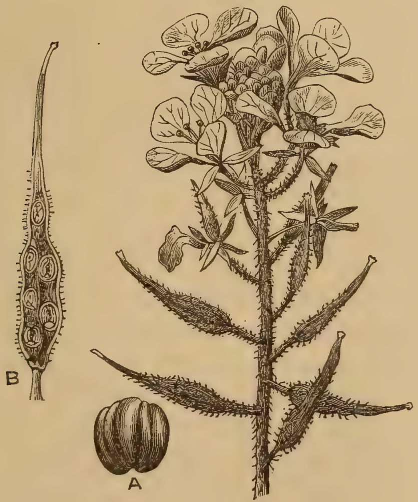
Rubefacients are employed to remove congestion and inflammation, to rouse the capillary system in cases of local torpor, to relieve pain and spasm, and as stimulants to the general system in coma, syncope, asphyxia, etc. They are adapted to cases in which a sudden and powerful, but transient action is called for; but they may be employed where a slight and long-continued action is desired. In removing congestion and inflammation, rubefacients act by stimulating the capillary vessels of inflamed parts, and thereby restoring their tone and elasticity. That they can influence distant organs was pointed out by Brown-Séquard, who called attention to the fact that when the skin over the kidneys was irritated the renal arteries contracted, hence we can understand what important service a rubefacient, as a mustard-plaster, may render, in conditions of renal hyperemia. They are useful chiefly in the forming stages or in light grades of inflammation. They are very serviceable local anodynes when applied to painful parts—acting by a *substitutive* influence. As general stimulants, their efficacy in rousing the system depends partly on their action on the capillary circulation, and partly on the pain which they produce. They are most valuable in the coma or asphyxia resulting from poisons, drowning, etc., and are inferior to blisters in the cerebral oppression which occurs in fevers, inflammation of the brain, etc.

Rubefacients are usually applied till pain and redness supervene. If kept too long on the skin, many of them will produce vesication and even gangrene; and in cases of coma particularly, caution is required, as the patient may not feel them till dangerous inflammation has occurred.

SINAPIS ALBA—WHITE MUSTARD.
SINAPIS NIGRA—BLACK MUSTARD.

MUSTARD SEEDS are obtained from two varieties of Sinapis—S. nigra, or Black Mustard, and S. alba, or White Mustard (*Nat. Ord.* Cruciferæ), small annual European plants, cultivated in our gardens. S. nigra has become naturalized in some parts of the United States.

FIG. 54.



SINAPIS ALBA; A. SEED; B. SEED-POD.

DESCRIPTION.—*Black mustard seeds* are small, globular, of a deep brown color externally, and internally yellow. They are inodorous, except in powder; and when rubbed with water exhale a very strong, pungent smell. Their taste is bitterish, hot, and pungent. *White mustard seeds* are larger, yellowish externally, and of a less pungent taste, owing to the presence of a mucilaginous substance in their skin. The *powder* of both varieties (commonly called *flour of mustard*) is yellow, and is often adulterated with colored wheaten flour. Both varieties yield their virtues wholly to *water*, and very slightly to alcohol.

CHEMICAL CONSTITUENTS.—Mustard seeds yield, upon pressure, a *fixed saponifiable oil*, which contains oleic acid and a peculiar acid termed *erucic* ($HC_{22}H_{41}O_2$). From the *black seeds* a very pungent *volatile oil*, containing sulphur, is afterwards obtained by distillation; *it does not pre-exist in the seeds, but is the result of the action of water upon a peculiar principle called sinigrin or potassium myronate* ($C_{10}H_{18}NS_2KO_{10}$), which is split into allyl sulphocyanide (C_3H_5CyS), acid potassium sulphate ($KHSO_4$), and sugar ($C_6H_{12}O_6$). This oil is colorless or pale yellow, rather heavier than water, of a pungent odor and of an acrid, burning taste. Allyl sulphocyanide is the principle to which the black seeds owe their activity. From the *white seeds* no volatile oil is obtained; but when treated with water they yield an *acrid fixed principle*, which is analogous in properties to the volatile oil of the black seeds. *It is the result of the reaction of water upon sinalbin* ($C_{30}H_{44}N_2S_2O_{16}$), a peculiar ingredient of the white seeds, which is decomposed into acrinyl sulphocyanide (C_8H_7NSO), sinapine sulphate ($C_{16}H_{25}NSO_9$), and sugar ($C_6H_{12}O_6$). The development of the volatile oil in the black seeds, and of the acrid fixed principle in the white seeds, is supposed to depend upon the presence of an albuminous constituent called *myrosin*, which acts the part of a ferment in determining a reaction between water and the peculiar principles of the seeds. Myrosin is rendered inert by heat, alcohol, and the acids; and water, of the ordinary temperature, is therefore the proper menstruum of mustard.

EFFECTS AND USES.—Mustard is an *acrid stimulant*. In small quantities it is stomachic; in larger doses it proves emetic; and in excessive doses it will produce gastro-enteric inflammation. When *applied* to the skin it is a rapid and powerful local excitant, speedily producing redness and pain, and if long continued, vesication, ulceration, and even sphacelus. Mustard seeds, swallowed whole, have been used as a laxative in dyspepsia, in the dose of a tablespoonful once or twice a day, mixed with molasses; the white seeds are preferred; the practice is, however, of doubtful value, as they may become entangled in the appendicula vermiformis. When mustard is employed *internally*, however, it is chiefly as an emetic, in cases of torpor of the stomach, particularly after *narcotic poisoning;* and by its stimulant action, mustard often arouses the gastric susceptibility when other emetics fail.

The most general use of mustard is, however, as a cutaneous stimulant or *rubefacient-poultice* in the form of *cataplasm* (termed a *sinapism*). This is made by mixing flour of mustard with a sufficient quantity of tepid-water to give it proper consistence, and it may be diluted with wheat-or rye-flour if a weaker effect is desired. *Sinapisms* are used when a speedy and powerful rubefacient effect is required. They are applied to the nape of the neck as a counter-irritant in *apoplexy* to restore consciousness, to the same region in *cerebral meningitis* during the stage of excitation; to relieve the pains of *muscular rheumatism*, *myalgia*, and to the sterno-mastoid muscle in *torticollis*. The application of a sinapism is a valuable counter-irritant to the integument of the throat in *croup*, *acute laryngitis*, *hoarseness*, and to the chest in *acute bronchitis*. In intestinal disorders, as *duodenal catarrh*, *colic*, *cholera morbus*, and *cholera*, the effects of mustard applied to the epigastrium or abdomen, for the purpose of checking vomiting and relieving cramp, are most valuable.

Mustard diffused through warm water in which the feet and legs are soaked is a popular revulsive remedy at the onset of *bronchitis*, *fever*, *headache*, etc. In the form of a warm sitz-bath in *delayed menstruation*, taken at the time the period is due, it will often reëstablish the flow. Sinapisms should be kept on till pain and redness are produced, usually from a quarter of an hour to an hour, and in cases of insensibility their effects should be carefully watched. They are applied spread on linen, and covered with gauze to prevent adhesion to the skin. Mustard is the most active and at the same time the most easily controlled of the rubefacients; a mild but permanent effect may be kept up by the addition of a teaspoonful to a tablespoonful of mustard to a poultice of Indian meal or flaxseed, with a tablespoonful or two of capsicum.

For ready use there is now kept in the shops *charta sinapis* (*mustard-paper*), which is prepared by mixing black mustard (in powder) with enough solution of gutta-percha to give it a semi-liquid consistence, and then applying the mixture by a brush to a piece of stiff paper; each square inch contains about gr. vj of mustard. Before being applied to the skin it should be dipped for about fifteen seconds in lukewarm water.

ADMINISTRATION.—The dose of mustard, as an emetic, is from a large teaspoonful to a tablespoonful of the bruised seeds or powder. Its use in smaller quantity, as a condiment and stimulant of the digestive organs, is well known. In the form of *whey* (℥ss boiled in milk Oj) it has been given as a diuretic in *dropsy*.

Oleum sinapis volatile (*volatile oil of mustard*), the volatile oil obtained from black mustard by maceration with water and subsequent distillation, possesses the properties of mustard. It is very irritant. It is used in making—

Linimentum sinapis compositum (*compound liniment of mustard*), which is composed of volatile oil of mustard (3 parts), extract of mezereum (2 parts), camphor (6 parts), castor-oil (15 parts), and alcohol (enough to make 100 parts by weight).

A mixture of oil of mustard, chloroform and camphor, under the name of *Nervol*, is used with good effect for the relief of *toothache*, by rubbing a few drops on the cheek.

CAPSICUM.

Capsicum has been previously noticed as an *aromatic stimulant* (see p. 223). It is an efficient rubefacient, useful in rheumatism, low fevers, etc.; the *plaster*, *tincture*, or *oleo-resin* may be used.

OLEUM TEREBINTHINÆ—OIL OF TURPENTINE.

The *Oil of Turpentine* (see index) is a speedy and efficacious rubefacient, and sometimes produces a vesicular eruption. It is employed in low forms of disease attended with coldness of the surface; as a counter-irritant in inflammation; and as a stimulating liniment in *rheumatic* and *paralytic cases*. It is often diluted with olive-oil.

LINIMENTUM AMMONIÆ—LINIMENT OF AMMONIA.

This preparation, called also *Volatile Liniment*, consists of 30 parts of *water of ammonia* (see p. 221, *et seq.*) and 70 parts of cotton-seed oil. It is an excellent application, as a counter-irritant, in affections of the throat and chest, etc.

PIX BURGUNDICA—BURGUNDY PITCH.

This is the prepared RESINOUS EXUDATION from Abies excelsa, or Norway Spruce (*Nat. Ord.* Coniferæ), a lofty evergreen tree of

Europe and northern Asia. Abies picea, or the European Silver Fir, is said to be also a source of the drug.

Preparation and Constituents.—It is obtained by stripping off the bark and detaching the flakes of resinous matter which form upon the surface of the wound; they are afterwards melted in boiling water and strained. Burgundy pitch is collected principally in Germany and France, and derives its name from Burgundy, in the latter country. After it is imported into the United States it is generally re-melted and strained to free it from impurities; and as found in the shops it is a hard, brittle, opaque substance, of a yellowish or brownish-yellow color and a weak terebinthinate taste and smell; when applied to the body it softens and becomes adhesive. It contains *resin* and a much smaller proportion of *volatile oil* ($C_{10}H_{16}$) than turpentine.

A *spurious Burgundy pitch* is made by melting together pitch, resin and turpentine, and agitating the mixture with water.

Effects and Uses.—This is a *gentle rubefacient*, producing a slight degree of inflammation and serous effusion, without separating the cuticle. It occasionally produces a papillary or vesicular eruption; and sometimes, though rarely, occasions painful vesication and even ulceration. It is applied in the form of *plaster* to the chest in chronic and subacute pulmonary disorders, as *bronchitis*, to the loins in *lumbago*, to the joints in *chronic articular affections*, and for the relief of *local rheumatic pains*.

Emplastrum Picis Burgundicæ (*Burgundy pitch-plaster*) consists of 80 parts of Burgundy pitch melted with 10 parts of yellow wax, which is used to give consistence to the pitch. *Emplastrum picis cum cantharide* (*pitch-plaster with cantharides*) consists of 92 parts of Burgundy pitch melted with 8 parts of cerate of cantharides: this is commonly called the *warming plaster*, and is a more active rubefacient than Burgundy pitch, though it does not usually blister. It is a useful application in *myalgia*, *lumbago* and *bronchitis*. The *iron-plaster*, *galbanum-plaster* and *opium-plaster* all contain Burgundy pitch.

PIX CANADENSIS—CANADA PITCH.

This is the prepared RESINOUS EXUDATION from Abies canadensis, or Hemlock Spruce (*Nat. Ord.* Coniferæ), a very lofty evergreen tree of Canada and the northern part of the United States.

Preparation and Constituents.—The pitch (sometimes called *hemlock-gum*) is a spontaneous exudation on the old trees. The portions of bark upon which it hardens are stripped from the tree and boiled, and the melted pitch is skimmed from the surface of the water. It undergoes a further purification in the shops by melting and straining, and is found in hard, brittle, opaque masses, of a dark yellowish-brown color, a weak, peculiar odor and scarcely any taste. It is more readily softened by heat than Burgundy pitch, and is, therefore, sometimes a less convenient application. Its constituents are *resins* and a minute portion of *volatile oil.* By Maisch the spruce gum of the shops is said to be the product of Abies nigra. Its *effects* and *uses* are the same as those of Burgundy pitch.

Emplastrum Picis Canadensis (*Canada pitch-plaster*), sometimes called *hemlock pitch-plaster*, consists of 90 parts of Canada pitch melted with 10 parts of yellow wax.

Many other substances are occasionally employed as *rubefacients.* GINGER (*vide* p. 227), BLACK PEPPER (*vide* p. 224) and GARLIC (*vide* index) are particularly deserving of mention. A gentle counter-irritant, often used to the epigastric region to relieve *vomiting*, is the *spice-plaster*, which is made by mixing ʒij of powdered ginger with ℥j of powdered cloves and cinnamon, each, and ʒij of capsicum, adding f℥ss of tincture of ginger and honey enough for proper consistence.

EPISPASTICS.

Epispastics, called also *Vesicants* and *Blisters*, are medicines which, when applied to the skin, produce inflammation, accompanied by effusion of serum beneath the cuticle. Many of the rubefacients will blister if kept on the skin a sufficient length of time; and, on the other hand, the action of vesicants may be made not to extend beyond rubefaction. The first effect of a vesicant when applied to the integument is to redden the skin, the superficial vessels becoming dilated, and a sense of burning is set up in the part. If the irritation be continued serum, plasma and corpuscles begin to ooze from the vessels, the epidermis is raised and a vesicle is formed, varying in size according to the extent of the exciting cause. Considerable local pain now ensues, and should the irritation be sufficiently severe or prolonged, a crop of pustules appears. The inflammation of the skin caused by vesicants is erysipelatous in its character, and may result in sloughing or gangrene. In inflammation of the dermoid tissues, as rubeola and scarlatina, in typhus under certain circumstances, in debilitated conditions of the system, and in extreme infancy, vesicants may produce serious consequences.

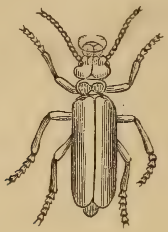
This class of agents is employed—1. As *local* stimulants, in the cure of internal inflammations as *chronic synovitis*, *gonorrhœal* and *chronic rheumatism*. Different explanations have been offered of the antiphlogistic influence of blisters, some therapeutists ascribing it to a *derivative* or *revellent* action, by determining vascular and nervous energy to the seat of their operation, but it is more probably due to a stimulant effect extended to the capillary vessels of the inflamed organ, and experience has shown that, for the relief of internal inflammation, they cannot be applied too near the affected organ. In affections of the head and spine, blisters are pre-eminently useful, *meningitis cerebral* and *spinal* for example. 2. To substitute a healthy therapeutic inflammatory action, which subsides spontaneously, for a morbid action existing in the part to which they are applied. In this way vesicants are used for the cure of various cutaneous eruptions, particularly *chronic eczema*. 3. To relieve pain, which they do partly by a stimulant and partly by a substitutive influence. 4. To break up a train of morbid associations by the powerful impression which they make on the nervous system, as in the cure of spasmodic diseases, etc. 5. To stimulate the absorbing or secreting vessels of parts contiguous to the seat of their application; in this way they are useful in promoting the absorption of *dropsical effusions*, in the treatment of *ununited fracture*, etc. 6. As general stimulants, in *typhoid conditions* of the system, *coma*, *syncope*, etc. 7. As local stimulants, in threatened *gangrene*, *paralysis*, *facial palsy*, *sciatica*, etc. 8. As evacuants, chiefly for the purpose of local depletion. 9. In retrocedent *gout*, and in retrocession of the exanthematous eruptions. 10. To prepare a surface for the endermic application of medicines.

CANTHARIS—CANTHARIDES.

Cantharis vesicatoria, termed also Lytta vesicatoria, the Spanish Fly (*Class*, Insecta; *Order*, Coleoptera), is a cylindrical insect, from six to ten lines in length by two or three in breadth, with a large cornate head, an oblong body, and elytra, or wing-cases, of a beautiful, shining, golden-green color.

Habitat and Collection.—It is found most abundantly in Spain, Italy and the south of France, but occurs in all the temperate parts of Europe, and in western Asia. The Spanish flies swarm on certain trees and shrubs, and may be detected at a considerable distance by their strong fetid odor, which resembles that of mice. They make their appearance in May and June, and are collected in these months by persons protected by masks and gauntlets, who beat or shake them from the trees on which they lodge, and receive them, as they fall, upon linen cloths spread underneath. They are plunged into hot vinegar and water, or exposed to the vapor of boiling vinegar, and are afterwards dried in the sun or by drying-stoves. When perfectly dry they are packed in canisters, which are carefully closed so as to exclude air and moisture. They are usually imported into this country from some Mediterranean port. A highly-esteemed variety comes from south Russia, through St. Petersburg, which is distinguished by the large size and copper-color of the flies.

FIG. 55.



CANTHARIS VESICATORIA.

DESCRIPTION.—In the *dried* state, cantharides retain their form, color, odor, etc.; their taste is acrid, burning and urinous; their powder is of a grayish-brown color, interspersed with shining green particles. If exposed to moisture they are soon decomposed, most speedily when powdered. As, moreover, the powder is liable to adulterations, they should be always purchased whole, and should be powdered as they are wanted for use. They are liable to be attacked by mites, which destroy the interior soft parts: the best mode of preserving them is to expose them, in bottles, to the heat of boiling water, which destroys the eggs of the insect. A little camphor or ammonium carbonate, or a few drops of acetic acid or of chloroform, added to the flies, are also recommended as preservatives.

CHEMICAL CONSTITUTENTS.—The most important constituents of cantharides are a volatile oil, upon which the odor depends, and a neutral crystalline substance, termed *cantharidin* ($C_{10}H_{12}O_4$), which is the vesicating principle. Cantharidin is inodorous, tasteless, soluble in ether, chloroform, the oils, acetic acid, and boiling alcohol, and nearly insoluble in cold water and alcohol; but notwithstanding the insolubility of cantharidin, watery and alcoholic solutions of cantharides possess the medicinal properties of the insect,—the cantharidin being rendered soluble by combination with a yellow coloring matter in the insect. By the aid of heat, in the presence of water, cantharidin may be made to combine with the alkalies, being converted into cantharidic acid.

AIDS.—Internally as an aphrodisiac, phosphorus, and strychnia; topically, the vesicants, as aqua ammoniæ fortis, sinapis, etc.

CONTRAINDICATIONS.—Acute renal inflammation; in debilitated subjects blisters may excite sloughs; applied to the recumbent parts of bed-ridden people there is danger of making bed-sores.

PHYSIOLOGICAL EFFECTS.—The activity of cantharis depends on the presence of cantharidin. *Applied to the skin*, cantharides produce inflammation which terminates in the secretion of serum under the cuticle in the form of vesicles which unite to make in 7 to 10 hours a large bulla. Even when they are externally applied their constitutional effects, as strangury, tenesmus, etc., are frequently manifested. Cantharides are an acrid stimulant. Taken *internally* they irritate the mouth and fauces, and reaching the stomach they produce a sensation of heat and gastrodynia, all more or less emphasized according to the amount swallowed. Cantharidin rapidly passes into the blood, augmenting the secretion of the kidneys, and in large amounts produces irritation of the genito-urinary passages, which is evinced by strangury, priapism, pain and occasionally the discharge of bloody urine. Erotic excitement does not, however, always follow the ingestion of cantharides. Pallé[*] has recorded his observations on this point, obtained by questioning a number of men who had taken the drug, and in none was amatory desire present. Christison affirms the same thing while Pereira[†] holds to the contrary. It would seem most probable that only small doses are likely to prove aphrodisiac, large ones being too violent to admit of such action. In full doses cantharides excite the heart and quicken the pulse and respiration. Galippe[‡] found that when injected into animals the chief symptoms were dysuria, hematuria, vomiting, dilatation of the pupil, enfeebling of the general sensibility, collapse and death. The chief post-mortem lesions were inflammation of the digestive tube, kidneys, and bladder.

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[*] *Journ. de Pharm. et de Chimie*, 13, 1871, p. 431.

[†] "Mat. Medica.," Vol. II.

[‡] *Gaz. Hebdom.*, 1874, 2d ser., p. 438.

Toxicology and Antidotes.—In large doses they produce violent gastro-enteric and genito-urinary inflammation; and in excessive doses prove fatal, with convulsions, tetanus, delirium, and other cerebro-spinal symptoms. Twenty-four grains[*] have occasioned death, while recovery has followed[†] the swallowing of f℥vj of the tincture. In cases of poisoning, after the stomach has been emptied, opiates, demulcents and stimulants are to be resorted to, but oils are to be avoided, as cantharidin is soluble in this menstruum.

Medicinal Uses.—The indications which cantharides are capable of fulfilling, when administered *internally* as a diuretic, emmenagogue, etc., have been already noticed (*see* index). Their chief use is as an *external application*, to produce *blisters* (see Epispastics); but they are sometimes employed also externally as *rubefacients*, for the purpose of local or general stimulation in low forms of disease. Cantharides are preferred to all other substances as *epispastics*, and they are used for all the medicinal purposes that are within the range of this class of medicines.

The following are the forms under which Spanish flies are used *externally*:—

Ceratum cantharides (*cantharides cerate*), commonly known as *blistering cerate*, is made by mixing powdered cantharides (35 parts) with melted wax and resin (each 20 parts) and lard (25 parts). This is the preparation usually employed to raise a blister. It can be applied without the aid of heat, and should be spread on soft leather, or linen, or adhesive plaster, and covered with gauze or unsized paper. From four to twelve hours is the period for which the cerate should be applied; on the scalp a longer application may be required. For an ordinary impression, and where the cutaneous sensibility is not impaired by disease, it need not be kept on more than four or five hours. In cases of children less time is required for the application of the cerate, and great caution is necessary in applying it to infants. A poultice of bread and milk or flaxseed meal should be afterwards applied, which usually produces vesication if the action of the blister has not extended beyond rubefaction. If it be desirable to *heal* the blistered surface immediately, cotton-wadding or cerate may be placed over it, after the serum has been allowed to escape, the blebs being punctured at their most dependent points. To *maintain* the discharge the cuticle should be removed and basilicon ointment applied; if the surface require further irritation, the ointments of savine, mezereon or cantharides may be used. The open or perpetual blister is, however, not required for ordinary antiphlogistic purposes; and indeed, as a general rule, the blistered surface should be allowed to heal as speedily as possible. In cases of excessive pain a poultice of bread-crumb and lead-water, with morphine sulphate gr. ¼ mixed in it, or a starch-poultice or lime-liniment, is a soothing application. Goulard's cerate is an excellent application to heal obstinate ulcers from blisters. For the relief of *strangury*, diluents and diuretics are proper, as flaxseed tea, with sweet spirit of nitre, decoction of uva ursi, etc., and an opium or morphine suppository if the symptoms are severe. Blisters should not be applied directly over an inflamed part as they may increase capillary dilatation and the pain, where the skin is loose, over bony prominences, or to the mammary glands in pregnancy. The danger of strangury should also be borne in mind. A thin piece of silver-paper, or camphor sprinkled on the blister is said to prevent this effect. *Ceratum extracti cantharidis* (*cerate of extract of cantharides*) differs chiefly from the common cerate in being made with an alcoholic extract of the flies instead of the flies themselves; it is said to be more active than the former preparation. To prepare it, 30 parts of cantharides are to be percolated to exhaustion with stronger alcohol, evaporated to the consistence of a soft extract, and mixed with 15 parts of resin, 35 parts of yellow wax and 35 parts of lard (melted together). Ethereal, alcoholic, hydro-alcoholic and watery extracts of cantharides have been suggested as substitutes for the blistering cerate, and, mixed with wax and spread on thin cloth or paper, are termed *vesicating taffetas*. *Linimentum cantharidis* (*liniment of cantharides*) consists of cantharides (15 per cent.) dissolved in oil of turpentine; it is a prompt stimulating liniment, and may be applied to the skin to prepare it for the action of the blistering cerate. *Collodium cum cantharide* (*collodion with cantharides*) or *cantharidal collodion*, is made by percolating cantharides with commercial chloroform until the cantharides are exhausted, evaporating the liquid thus obtained and dissolving the residue in flexible collodion. It should be kept in a cool place. It furnishes a very convenient mode of blistering a small irregular surface, and is applied by means of a camel's-hair brush, in successive layers which should be covered with a piece of oiled silk. Applied to the glans penis it will prevent *masturbation* during the existence of the bleb. *Charta cantharidis* (*cantharides paper*) is made by boiling gently a mixture of 8 parts of white wax, 3 parts of spermaceti, 4 parts of olive-oil, 1 part of Canada turpentine and cantharides each, in 10 parts of boiling water, and, after filtration, passing strips of paper over the surface of the mixture, which, when dry, are cut into rectangular strips. The cantharidal preparations are used externally to promote the growth of the hair, in functional *alopecia*, and to destroy the tinea of *ringworm*. *Dupuytren's Pomatum* is a tincture made with cantharides, ʒj, and alcohol, f℥j, incorporated with nine parts of lard.

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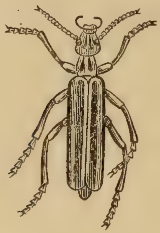
[*] Taylor's *Med. Jurisprudence*, I, 1883, p. 350.

[†] *Ibidem.*

Cantharis Vittata (*Potato-Flies*) (not official). Several species of cantharis are found in the United States, and are good substitutes for C. vesicatoria. C. vittata, or the *Potato-fly* is most used. It resembles the Spanish fly in shape, but is rather smaller being about six lines in length, with black elytra or wing-cases, and inhabits chiefly the potato-plant. It contains *cantharidin*.

FIG. 56.



CANTHARIS VITTATA.

AQUA AMMONIÆ—WATER OF AMMONIA.

Stronger Water of Ammonia (*vide* p. 221) may be used for the purpose of speedy vesication. It is more rapid, but much more painful than cantharides. Five parts of this, mixed with spirit of camphor, 2 parts, and spirit of rosemary, 1 part, has been used as a prompt vesicant, under the name of *Granville's Lotion*. A piece of flannel saturated with the liniment, is applied to the skin which it will generally blister in from three to ten minutes. *Gondret's Vesicating Ointment* is made by melting together 2 parts of expressed oil of almonds and 32 parts of lard, and adding to this mixture 17 parts of stronger water of ammonia; it will vesicate in ten minutes. Ammonia is applied *locally* as an antidote to the *poison of venomous reptiles and insects.*

SUPPURANTS.

OLEUM TIGLII—CROTON OIL.

Croton Oil (*vide* p. 371), when rubbed on the skin, produces rubefaction, accompanied by a pustular eruption. It is used as an application to the throat and chest in *subacute, or chronic laryngeal* and *bronchial affections*, *hoarseness* and to *rheumatic joints.* It may be applied undiluted or mixed with one, two or three parts of olive-oil, or oil of turpentine, according to the susceptibility of the skin.

UNGUENTUM ANTIMONII—ANTIMONIAL OINTMENT.

This ointment consists of 1 part of antimonium and potassium tartrate mixed with 4 parts of lard. The peculiar eruptive effects of tartar emetic have been already noticed (*see* p. 250). It may be used in the form of ointment or solution in the same cases as croton-oil, but it is a more painful and permanent application.

ESCHAROTICS.

Escharotics (from *ἐσχάρα, an eschar*), called also *Cauterants,* are medicines which destroy the structure and vitality of the parts to which they are applied. The *eschar* which their application produces is followed by inflammation and suppuration of the surrounding tissues, by which the slough is separated from the living parts.

They are employed—1. To effect the destruction of morbid growths, warts, condylomata, polypi, fungous granulations, etc. 2. To destroy the virus of rabid and venomous animals, and of chancres and malignant pustules, and to prevent their absorption. 3. For the cure of violent inflammation, by their *substitutive* action, as when they are applied to the mucous or cutaneous surfaces, in gonorrhœal ophthalmia, erysipelas, poisoned parts, carbuncles, etc. 4. To stimulate indolent sinuses, ulcers, etc., where their influence is also of a *substitutive* character. 5. To form issues. 6. To remove morbid heterologous growths, as lupus, cancer, warts, etc.

ARGENTI NITRAS FUSUS—FUSED SILVER NITRATE.

Lunar Caustic (described at p. 208) is the most commonly employed of the caustics. It has the advantage of not liquefying when applied, and its action is therefore confined to the parts with which it is brought in contact, and is superficial.

Medicinal Uses.—It is used to remove fungous granulations in *wounds* and *ulcers*, to destroy *warts*, to alter the action of indolent *ulcers*, *sinuses*, and *fistulæ*, to subdue the inflammatory action of *paronychia*, *erythema*, etc., to arrest the progress of *erysipelas* and *cancrum oris*, to cut short *variolous pustules*, to cure skin-diseases by a substitutive action, and in inflammations of mucous membranes. In dilutions of various strengths it is resorted to in every variety of inflammation of the mucous membranes; when a full impression is desired, a solution of gr. xx–xxx in distilled water f℥j may be employed; for ordinary purposes, gr. ij to water f℥j. The *diluted silver nitrate* (*vide* p. 208) is also used externally.

POTASSA.

Preparation and Description.—*Caustic Potassa* is prepared by the rapid evaporation of *Solution of potassa* (*vide* p. 473) with heat. While in the state of fusion, it is received into cylindrical iron-moulds, and it occurs in the form of sticks of a brownish, grayish or bluish color, of a fibrous fracture, the odor of slaking lime, and a caustic urinous taste. It dissolves in alcohol and in less than its weight of water, and attracts both moisture and carbonic acid rapidly from the air. It is more or less impure as found in the shops. By digestion in alcohol it is freed from impurities insoluble in this menstruum (as the potassium carbonates), and it may be afterwards obtained quite white and pure by evaporation; it is then termed *alcoholic potassa*. The potassa of the shops is a *hydrate*, consisting of the elements of water and potassium.

Effects and Uses.—It is the most powerful known escharotic, and differs from lunar caustic in extending its action to a considerable depth beneath the surface to which it is applied. It acts by absorbing the water of a part and converting it into a slough. It is used chiefly to form issues, to destroy the virus of *chancres* and of *malignant pustules*, and that from the *bites of venomous reptiles* and *rabid animals*, and sometimes also to arrest the sloughing of *carbuncles*, and, from its deep-reaching action, it is preferred to lunar caustic in these cases; applied to the cutaneous surface, in cases of threatened *abscess*, *carbuncle*, etc., it will sometimes avert the progress of the inflammation. It is a good application in cases of *rodent ulcer*, the superficial forms of *epithelioma* generally, and in *lupus*, the diseased tissue having been removed with a knife as thoroughly as possible previous to the application of the caustic. When it is applied to the skin, this should be covered with linen spread with adhesive plaster, having a hole the size of the spot to be cauterized. A solution (ʒjss to f℥ij of water) is used as a *rubefacient.*

Potassa cum Calce (*Potassa with Lime*) is prepared by rubbing up equal parts of potassa and lime. It is a grayish-white powder, which is sometimes made into a paste with a little alcohol, and is termed *Vienna Paste;* it has been also formed into sticks. The presence of lime renders this a milder, less deliquescent and more manageable caustic than potassa; it is a favorite application to *chancres*, *nævi*, and *rodent ulcer.*

SODA.

Caustic Soda is prepared by the rapid evaporation of *Solution of soda* (*vide* p. 476) until ebullition ceases and the soda melts; when it has congealed, it is broken into grayish-white, opaque, brittle fragments, which are very corrosive, very soluble in water, soluble in alcohol, and deliquescent, though, unlike potassa, it does not become permanently liquid, but after a time effloresces.

Effects and Uses.—It is employed for the same cauterant purposes as potassa, than which it is somewhat milder in action. *London Paste* is made by rubbing equal parts of soda and lime.

ACIDUM CHROMICUM—CHROMIC ACID.

Preparation and Description.—Chromic Acid (CrO_3) is obtained by the reaction of sulphuric acid upon a solution of potassium bichromate. It is properly *chromic anhydride*, and occurs in the form of anhydrous, deep-red, needleform crystals, of an acid, metallic taste; they are deliquescent and very soluble in water, with which they form an orange-yellow solution.

Incompatibles.—Chromic acid is incompatible with organic matter; it must not be mixed with glycerin, alcohol, etc., as decomposition and explosion may ensue.

Effects and Uses.—This is an *escharotic* of great power, decomposing the tissues by its rapid oxidizing action and staining them blackish-brown. Used in the form of paste, or solution more or less diluted, it is a most efficacious application to *lupus*, *morbid growths and excrescences*, as *syphilitic condylomata*, etc., and is unequalled as an agent for removing *warts* from the hands. It gives less pain than other caustics; but it is to be used with caution, especially near delicate parts like the eye, as its action is deeply penetrating. The solution may be made of the strength of from gr. 100–℥j to f℥j of water; and is to be applied by means of a pencil or glass-rod. A 5 per cent. solution of chromic acid will check the *fetor of sweating of the feet*, but the skin must not be broken.

ACIDUM ARSENIOSUM–ARSENIOUS ACID.

This is a powerful escharotic (*vide* p. 457), and is occasionally applied in *lupus*, *onychia maligna*, *cancerous ulcers*, and to change the action of *indolent sinuses*; but its use is attended with danger. When used, it should be applied freely, as a large amount causes such rapid death of the tissues that absorption is rendered impossible. It may be diluted with one or more parts of sulphur.

BROMUM—BROMINE.

PREPARATION, DESCRIPTION AND TESTS.—Bromine (Br) is an elementary body, bearing close chemical affinities to iodine. It is a constituent of sea-water and of many mineral springs. In Europe it is obtained principally from the mother liquors of the salt mines of Stassfurt, in Germany; in this country, from saline springs in western Pennsylvania, Ohio, and West Virginia, in which it exists as magnesian bromide. It is a volatile, dark-red liquid (sp. gr. 3), of a caustic taste and a strong, disagreeable smell, sparingly soluble in water, more soluble in alcohol, and still more so in ether.

Tests.—With starch-paste it yields a yellow color; with silver nitrate, a yellowish-white precipitate.

PHYSIOLOGICAL EFFECTS.—The action of bromine on the system considered chemically is very similar to that of chlorine. It decomposes hydrogen compounds, forming hydrobromic acid, and separating the elements combined with the hydrogen; hence it is a deodorant and disinfectant. On account of these properties, and because it is a liquid, it is a severe, rapid and thorough caustic. The vapor is intensely irritant to the mucous membrane, causing, when inhaled in sufficient quantity, laryngitis, bronchitis, and pneumonia.

TOXICOLOGY.—In the stomach it is a corrosive poison. Snell[*]

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[*] *N. Y. Journ. of Med.*, 1850, p. 179.

reports a case in which ʒj killed an adult in seven hours. The symptoms were immediate dyspnœa, epigastric pain, trembling of the hands and great anxiety.

MEDICINAL USES.—In *acute* and *chronic nasal catarrh*, *ozœna*, and *hay-asthma*, a small quantity of a solution (ʒss) in alcohol (f℥jv) may be inhaled from a wide-mouthed vial with good result.

Locally, in *hospital gangrene*, after removing the slough, it is one of the best escharotics. It is also used as a caustic in *chancre*, *phagedena*, and various forms of *cancer*, especially *cancer of the uterus*. It is never employed internally.

ZINCI CHLORIDUM—ZINC CHLORIDE.

This is also a powerful escharotic (*vide* p. 205); and, in addition to its corrosive properties, it appears to exercise a greater influence over the vital action of neighboring parts than some other caustics. The separation of its eschar leaves very healthy and vigorous granulations, and it is one of the best applications that can be made to intractable, *indolent ulcers* and *sinuses*. It will sometimes cure *lupus*.

LIQUOR HYDRARGYRI NITRATIS—SOLUTION OF MERCURIC NITRATE.

This preparation (*vide* p. 443,) termed also the *acid* nitrate of mercury, is a valuable caustic application to *malignant ulcers*, *hospital gangrene*, *chancre*, etc.

HYDRARGYRI CHLORIDUM CORROSIVUM—CORROSIVE CHLORIDE OF MERCURY.

Corrosive Sublimate is more frequently used as a stimulant or antiseptic wash than as a caustic (see p. 438).

POTASSII BICHROMAS—POTASSIUM BICHROMATE.

This salt, already noticed under the head of Alteratives (*vide* index), is a good caustic application, in saturated solution or in powder, to *syphilitic and other vegetations*.

ACIDA MINERALIA—MINERAL ACIDS.

The mineral acids (*vide* p. 176) are powerful escharotics, but are inconvenient for many uses, on account of the extension of their action beyond the point of application. On the other hand they can be made to reach the bottom of *sinuses* and *fistulæ*, which are inaccessible to the solid caustics. Nitric acid, for such purposes, has no equal in the list of escharotics; it is used also to destroy *warts.* It stains the tissues yellow. Properly diluted, the mineral acids are employed in injections, gargles, etc.; and in the form of ointment, in skin-diseases.

Copper Sulphate (*vide* p. 202) and **Alum** (*vide* p. 211) are mild escharotics, but are used chiefly to remove fungous granulations in *ulcers*, as a mild cauterant to granulations in *ophthalmia*, to *mucous patches*, etc. The *actual cautery* and *moxa* have been alluded to under the head of **Heat** (*vide* p. 41).

Under "Irritants" may be considered *sapo viridis* and *chrysarobin*, two remedies which, although not used as escharotics, are applied to the skin in certain of its diseases for their local irritant effect. The former has decided caustic properties, due to the potassa which it contains.

Sapo Viridis—*Green Soap*—is a soft, greenish, jelly-like soap, prepared from potassa and the fixed oils, very soluble in water and alcohol. Like all soaps, especially soft soaps, it is a mild caustic, and was introduced into medical practice by Professor von Hebra, in the treatment of various cutaneous affections, especially of the scaly variety.

Medicinal Uses.—It is useful to remove the infiltrated patches of the various forms of *chronic eczema*, and for this purpose should be well rubbed in with a piece of flannel until all traces of the soap have disappeared, when the flannel is wet with water and the rubbing again performed; the surface should be then washed with clean water and carefully dried, when it will be found red and angry-looking, with here and there a minute point from which serum is oozing. Between the applications ointments are to be applied. Sapo viridis is also much used to get rid of scales and crusts, as in *psoriasis*, *phthiriasis*, and in various other skin-affections. As a local stimulant in *alopecia*, the following makes a serviceable lotion, saponis viridis, ℥ij, alcohol, ℥j, M.S. Dissolve with heat and filter; apply as a shampoo. Green soap is also applicable to the removal of *freckles*, to cleanse the toes of sebaceous matter in *fetor of the feet*, and to prevent further friction about *chafed parts*. In *tinea versicolor* it will often effect a prompt cure, and it is highly useful to cleanse the skin in parasitic affections, as *tinea circinata* before the application of a germicide.

Tinctura saponis viridis (*tincture of green soap*) consists of 65 per cent. of green soap and 2 per cent. of oil of lavender dissolved in alcohol. It is milder in its action than green soap, and is used to fulfil the same indications.

Chrysarobinum—*Chrysarobin*, often improperly called *Chrysophanic Acid*—consists of a MIXTURE OF PRINCIPLES extracted from *araroba* or *goa-powder*, a substance found in the clefts of Andira araroba (*Nat. Ord.* Leguminosæ). It has also been obtained from different species of rhubarb. It is an orange-yellow powder, crystallizing in needles, insoluble in water, only slightly soluble in alcohol and chloroform, readily so in ether, and possesses neither taste nor smell.

PHYSIOLOGICAL EFFECTS.—When applied *locally*, it is an irritant to the skin, staining it yellow, and causing, in excess, irritation and inflammation, accompanied by swelling, itching, pain, heat, and sometimes a papular eruption, especially when in contact with the skin about the head and face. The action is not always limited to the part to which it is applied, but extends to the healthy skin in the vicinity. Observers do not agree respecting the *internal* effects of this drug.

MEDICINAL USES.—It is principally used as an *external* application in cases of skin-disease due to vegetable parasites as *favus*, the different forms of *tinea*, etc., for which it is an excellent remedy, and in *psoriasis*, in which disease the scabs soon disappear and the patches become white under its use. In the treatment of *ringworm* the parts should first be cleansed with sapo viridis in order to facilitate contact of the remedy with the parasite, and then the following solution should be applied: ℞ Chrysarobini, gr. v–x; chloroformi, f℥j. M. S.—Shake before using. After this is dry, liquor guttaperchæ may be painted on as a protective. The solution of chrysarobin should be applied every few days until the parasite is effectually destroyed. Alexander * reports excellent results in sixty cases of ringworm of the scalp from the use of a 10 per cent. solution of chrysarobin in gutta-percha solution. It must not be forgotten that chrysarobin produces a permanent stain upon clothing. It should be applied to the head or face with caution on account of the liability to swelling and œdema of the eyelids. It is never used internally. The *ointment* (made by rubbing 10 parts of chrysarobin with 90 parts of benzoinated lard) may be used.

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* *Journ. of Cutaneous and Venereal Diseases*, 1885, p. 33.

ORDER III—DEMULCENTS.

Demulcents, or *Lenitives*, are medicines which *soften* and relax the tissues, and when applied to irritated or inflamed surfaces, diminish heat, tension, and pain. They consist chiefly of gum or mucilage, or a mixture of these with saccharine and farinaceous substances, and form with water viscid solutions. Their constitutional effects are principally nutritive, though perhaps, to some extent, they relieve irritation in distant organs by modifying the acridity of the secretions. Demulcent solutions are administered internally—1. To sheathe and protect the gastro-enteric surface from the injurious effects of irritating substances, particularly acrid poisons. 2. To relieve irritation and inflammation of the alimentary canal, as in gastritis, enteritis, diarrhœa, and dysentery; and for this purpose they may be administered by either the mouth or rectum. 3. In catarrhal affections, in which they are probably useful in part by the transmission of their lubricating and soothing effects on the fauces and œsophagus by reflex action to the laryngeal and bronchial membranes, and in part by modifying the acridity of the expectorated matters. 4. In affections of the urinary passages, as strangury, cystitis, etc., and in these cases they act chiefly by diminishing the acridity of the secretions. 5. As agreeable drinks, to quench thirst and promote the action of the secreting and exhaling organs in febrile affections. Their effects in these cases are owing partly to the water which they contain, to which they are added merely for the sake of flavor, and partly also to the nutriment which they furnish. When administered with the object of increasing the proportion of the fluid parts of the blood, demulcents are termed *Diluents*. 6. As light diet for the sick. 7. For pharmaceutical purposes, to suspend substances insoluble in water, etc.

Externally, mucilaginous solutions are employed extensively to relieve the heat, swelling and pain of inflammation, wounds, burns, etc.; to hasten suppuration where inflammation is too far advanced for resolution; to cleanse foul and scabby ulcers; to promote suppuration from granulating surfaces, etc., etc. When applied externally, this class of medicines is termed *emollients*. Mucilaginous and amylaceous substances are applied to inflamed and ulcerated parts, mixed with water so as to form soft masses, termed—

Cataplasms or Poultices, which are useful vehicles for the application of heat and moisture. (For *flaxseed poultice see* p. 565). When applied to a healthy part a poultice acts as a sedative and relaxant. In the early stages of inflammation it lessens the amount of blood at the seat of morbid action, by dilating the cutaneous vessels, and prevents stasis and the migration of the white corpuscles; after stasis has taken place and migration has commenced, it favors the formation of pus, probably by aiding migration through the relaxing effect it exerts on the walls of the vessels, and also by promoting cell-proliferation: applied to a wound, it stimulates the formation of embryonic and granulation-tissue, from its influence over cell-proliferation. If the use of poultices be too long persisted in, the part becomes pale, sodden, relaxed and shrivelled and even devitalized, in extreme cases.

Poultices are used in the early stages of acute inflammation of internal viscera for their antiphlogistic effects: thus the abdomen may be covered with a large poultice in the early stages of *peritonitis*, if not objectionable on account of its weight, and a jacket-poultice may be used with excellent effect in the early stages of *acute bronchitis*, *pneumonia* or *pleuritis*, the chest being completely surrounded by the poultice. They are sometimes used for the same purposes in external inflammations. For their effects on pus-formation and cell-proliferation, and as they soften the skin, relax the cuticle thus lessening tension and pain, they are useful in external inflammation when suppuration can no longer be prevented, as in *boils*, *carbuncles*, *abscess*, *felon*, etc., and they are also applied to granulating surfaces, as in *wounds* or *ulcers*. As they stimulate the granulation-process, their application should be discontinued as soon as the granulations reach the level of the surrounding skin. During the day poultices, should be changed every three hours; at night, every four hours.

When applied to a granulating surface, or indeed, to an open wound of any kind, the poultice should be thoroughly antisepticised, as by admixture with a solution of corrosive sublimate, else it forms an excellent nidus for the development of various forms of protophytes, the multiplication of which will be accelerated by the heat and moisture.

In the treatment of gangrenous, sloughing or foul-smelling ulcers or wounds, *yeast* or *charcoal* is often added to the poultice, to aid in the separation of the slough or to correct the fetor. The *charcoal-poultice* contains wood-charcoal ℥½, bread-crumb ℥ij, linseed-meal ℥j½, boiling water, f℥x. M., adding the meal gradually. The *yeast-poultice* consists of beer-yeast f℥vj, wheat-flour ℥xjv, water at 100° F., f℥vj. Mix the yeast with the water and stir in the flour. Poultices may be *medicated* with lead-water and laudanum, or other substances, if it is desired to abate the inflammatory process. The *laudanum-poultice* is an efficient anodyne in *synovitis*. For the *rubefacient-poultice* see index.

AQUA—WATER.

Water has important medicinal as well as pharmaceutical uses. The Pharmacopœia directs it to be employed in the *purest attainable state*, which is rain or snow-water; for pharmaceutical purposes, *distilled water* (*aqua destillata*) should be used. Pure water is a transparent liquid without color, taste or smell; but owing to its extensive solvent powers, in the natural state it is more or less contaminated with foreign matters. It is a compound by volume of 2 atoms of hydrogen and 1 of oxygen (H_2O).

Effects and Uses.—Water is necessary for the solution and digestion of our food; in either insufficient or excessive amount it may prove injurious. Thus, without a proper supply of water, not only the absorption of soluble matters in the stomach is interfered with, but also the passage of undigested substances into the intestines; and in the absence of water, some articles, as sugar, do not undergo the fermentation necessary for digestion. On the other hand, an excess of water taken into the stomach impairs digestion by over-dilution of the gastric juice, and will occasion the acetous fermentation of saccharine articles. Water is eliminated from the system by the intestines, skin and lungs, but chiefly by the kidneys; and it is believed, in large amounts, to increase not only the water, but the solid constituents, of the urine; hence its use as a *diuretic*. It materially augments the perspiration particularly when taken warm, and is consequently of great value as a *diaphoretic*. As it promotes both the metamorphosis and construction of tissue, it may produce a valuable alterative effect in morbid taints of the system, and prove a useful adjunct to more active eliminative agents. Water is the basis of all drinks administered to relieve the thirst of fever and moderate the undue viscidity of the blood which is present in inflammation; it must not be permittted in excess, however, as undue amounts may produce nausea, flatulence and even vomiting and diarrhœa. Ice-water is best adapted to *febrile conditions*, sipped often and in small quantities. When drunk inordinately at meals, a custom prevalent in the United States, it acts not only injuriously upon digestion for the moment, but also superinduces a condition known as *ice-water dyspepsia.* To allay the thirst that follows a profuse perspiration brought on by exercise in warm weather, the fauces should be rinsed before drinking and the fluid then slowly swallowed in small quantities. In *constipation* a tumblerful of water taken before breakfast will commonly bring about an evacuation of the bowels. The uses of water, as an external agent, have been noticed under the head of *heat* and *cold.*

Carbonic Acid Water (H_2CO_3) (not official). Water impregnated with a quantity of *carbonic acid* equal to five times the bulk of the water (which may be obtained from sodium bicarbonate or from marble, by means of diluted sulphuric acid) often proves useful in allaying *nausea* and *vomiting,* and is also a good vehicle for some of the neutral purgative salts which are of unpleasant taste. M. Jacquemaire* has called attention to the value of carbonic acid water, under a pressure of four or five atmospheres, to sterilize aqueous solutions of the salines, the pyrophosphate of iron and pepsin.

Carbonic acid may be taken in the form of natural mineral waters, as *Apollinaris, Clysmic, Giesshübler* and *Summit Soda Springs* of California. These are particularly agreeable in cases of *fever,* and to relieve *nausea* and *vomiting.* Being alkaline they are adapted to prolonged use in the *uric acid diathesis,* particularly the Clysmic water. Mixed with milk they are well suited to *acid dyspepsia.*

ACACIA.

Acacia, or Gum arabic, is a *gummy exudation* derived from Acacia Verek and other species of Acacia (*Nat. Ord.* Leguminosæ), thorny or prickly trees or shrubs of Africa and Arabia. Considerable gum† is collected by the Somali tribe on the N. E. coast of Africa, who obtain it by incision.

PREPARATION AND VARIETIES.—The gum exudes either through natural cracks in the bark or through incisions made to facilitate its exudation, and hardens on exposure. Several commercial varieties are known, as Turkey, Barbary, Senegal, India, etc., of which the most important are Turkey gum and Senegal gum. 1. *Turkey gum*

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* *Bull. Gén. de Thérap.,* Août 15ième, 1888.

† *Journ. of Pharmacy,* XII, 226. J. Vaughan.

(Kordofan gum) is the kind usually found in the shops. It consists chiefly of small, irregular fragments, interspersed with larger pieces of a whitish color, which is sometimes slightly tinged with yellow or reddish-yellow. It is purer than other varieties, and is generally characterized by innumerable minute fissures pervading its substance. 2. *Senegal gum* occurs in roundish or oval unbroken pieces, sometimes whitish, but generally yellowish, reddish or brownish-red. 3. *Barbary gum* comes from Morocco, and consists of two kinds, one resembling the Turkey, the other the Senegal gum. 4. *India gum*, though brought from India, is collected on the northeastern coast of Africa, the Somali district, and in the ports of the Red Sea. It is in pieces of varying size, color and quality, and is often contaminated with Bassora gum, which is insoluble in water. All the varieties are more or less transparent, hard, brittle and pulverizable, and form a white powder. They are inodorous, with a feeble, slightly sweetish taste, and when pure dissolve wholly in the mouth. When kept in a dry place they undergo no change by time.

CHEMICAL CONSTITUENTS.—Acacia consists almost wholly of a peculiar proximate principle, usually termed *Gum*, but latterly designated as *Arabin.* It is soluble in hot or cold water forming a viscid solution called *mucilage*, and is insoluble in alcohol, ether and the oils. Its aqueous solution is acid. *Arabin* (*gummic* or *arabic acid*) ($C_{12}H_{22}O_{11}$) is combined with about 3 per cent. of lime, forming a soluble salt, calcium gummate. Gums of inferior transparency and solubility contain *bassorin*, an inert principle, insoluble in water and alcohol.

INCOMPATIBLES.—Alcohol precipitates gum from its aqueous solution; lead acetate (which is also a delicate test), lead nitrate, solution of the ferric salts and borax in concentration render its solution turbid and jelly-like.

AIDS.—Mucilage of tragacanth, slippery elm, and sassafras pith.

EFFECTS AND USES.—Acacia is extensively employed, *internally*, as a demulcent in gastro-enteric inflammation, as *gastritis, enteritis, diarrhœa, dysentery*, cases of *acrid poisoning*, etc.; as a lubricant to the fauces in *catarrhal affections, pharyngitis* for example; and also as a vehicle for anodynes and expectorants in cough mixtures; and as a diluent in *fevers* and *inflammatory cases.* It is not now considered to be digestible, and can scarcely rank (as formerly supposed) with nutrients.

Administration.—It is usually administered in solution (℥j to boiling water Oj, to be given when cool); in cases of irritation of the fauces it may be taken into the mouth and allowed slowly to dissolve. For pharmaceutical purposes acacia is much used to suspend insoluble substances in water, and in making pills and lozenges. *Mucilago acaciæ* (*mucilage of acacia*) is used in making pills, emulsions, etc.; it becomes sour by keeping. *Syrupus acaciæ* (*syrup of acacia*) (25 per cent. of mucilage of acacia mixed with 75 per cent. of syrup,) is used for the same purpose. *Mistura amygdalæ* (*almond mixture*) is made by dissolving a mixture of 6 parts of *blanched* sweet almonds, 1 part of acacia, and 3 parts of sugar, in 100 parts of distilled water; it is a pleasant demulcent and vehicle for other medicines. By dissolving equal parts of sugar and acacia in water and evaporating, an agreeable demulcent is obtained, known as *gum-pectoral*, which is sold as an imitation of *jujube paste.*

TRAGACANTHA—TRAGACANTH.

This is a GUMMY EXUDATION derived from the Astragalus gummifer and other species of astralagus (*Nat. Ord.* Leguminosæ), small shrubs found in Persia, Asia Minor and countries bordering on the Levant, with numerous branches covered with imbricated scales and beset with spines.

Preparation and Constituents.—Tragacanth exudes spontaneously in the hot weather, and hardens, as it exudes, in forms of various shapes. It occurs in irregular tortuous flakes or filaments, of a whitish or yellowish-white, or occasionally a slightly reddish color, somewhat translucent, resembling horn in appearance. It is hard and fragile, but very difficult of pulverization, and has no smell and very little taste. When heated with water it swells and forms a paste, and if agitated with an additional quantity it forms a uniform mixture, from which it is, however, almost entirely deposited upon standing a day or two. It contains two constituents, one soluble in water resembling *arabin*, but not identical with it, combined with calcium, the other termed *tragacanthin* ($C_{12}H_{20}O_{10}$).

Effects and Uses.—Tragacanth is seldom given *internally*, on account of its difficult solubility. It is useful in suspending heavy insoluble powders, and answers better than gum arabic to impart consistency to lozenges.

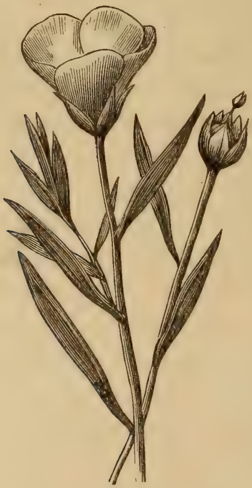
Administration.—*Mucilago tragacanthæ* (*mucilage of tragacanth*)—tragacanth 6 parts, with glycerin 18 parts, in water enough to make the whole weight 100 parts, is used in making pills and troches, and for the suspension of heavy insoluble metallic substances.

LINUM—FLAXSEED.

This is the SEED of Linum usitatissimum, or Common Flax (*Nat. Ord.* Linaceæ), an annual plant of the height of two feet, originally a native of eastern countries, but naturalized in Europe, and cultivated in all parts of the world The SEED and OIL are both official. The seeds are about a line in length, oval, smooth and glossy, of a brown color externally and yellowish-within ; a variety of flax is cultivated in Ohio, the seeds of which are a greenish-yellow. Flaxseeds are inodorous, and have an oily, mucilaginous taste.

CHEMICAL CONSTITUENTS.—They contain 30 or 35 per cent. of *fixed oil*, a large proportion of *mucilaginous matter*, *vegetable albumen*, etc.; the mucilaginous matter, which is found chiefly in the husks of the seeds, consists, about one half, of a principle soluble in cold water, resembling *arabin*, and about one-third of a principle insoluble in water. The *oil* (*oleum lini* or *linseed-oil*) is obtained by expression from the interior part of the seeds; it is laxative in the dose of f℥j.–ij, but it is chiefly applied externally, mixed with an equal amount of lime-water, as in the old "carron oil," to burns.

FIG. 57.



LINUM USITATISSIMUM.

EFFECTS AND USES.—Decoction is an improper mode of preparing a demulcent solution of flaxseed, as boiling extracts part of the oil; but it answers very well when it is used as a laxative enema. *Ground flaxseed* forms a much used *emollient poultice* (*vide* p. 559), which is prepared by gradually adding boiling water to flaxseed meal in a vessel previously heated, and constantly stirring until it makes a smooth dough of proper consistence, which is then spread on muslin and a piece of gauze or mosquito-netting placed upon it, to prevent it from adhering to the skin. After the poultice is applied, it should be covered with oiled silk or waxed paper, to retain the heat and prevent evaporation. The cake remaining after the expression of the oil, retains the mucilaginous and albuminous constituents of the seed, and forms a food for cattle, under the name of *oil-cake*. This is used for making poultices, but it is inferior to the meal made from the seeds which have not been deprived of their oil.

OLEUM GOSSYPII SEMINIS—COTTON-SEED OIL.

This is a FIXED OIL EXPRESSED from the SEED of Gossypium herbaceum (*vide* p. 275) and other species of Gossypium. It is subsequently purified by being bleached with alkalies and with sulphuric acid, and is finally obtained as a clear, pale-yellow, oily liquid, without odor and having a bland, nut-like taste. It contains *olein* and *palmitin*. It is very bland, and may be used as a substitute for almond or olive-oil. It is used externally as an ingredient of *linimentum ammoniæ* (*vide* index), *linimentum calcis* (p. 483), *linimentum camphoræ* (*vide* p. 126), and *linimentum plumbi subacetatis* (*vide* p. 200).

ULMUS—SLIPPERY-ELM BARK.

This is the INNER BARK of Ulmus fulva, or Slippery-Elm (*Nat. Ord.* Urticaceæ), a lofty indigenous tree which is found throughout the United States north of Carolina, and grows most abundantly west of the Allegheny Mountains.

DESCRIPTION AND CONSTITUENTS.—The inner bark is prepared for use by the removal of the epidermis; it is found in the shops in long flat pieces, of fibrous texture, tawny on the outer surface and reddish on the inner, of a peculiar but not unpleasant smell and a very mucilaginous taste. It affords a light grayish, fawn-colored powder. A large quantity of *mucilaginous matter* is contained in it, which is yielded readily to water, also some *tannic acid*. Much of the bark lately brought into the market is inferior, containing but little mucilage; it is less fibrous and more brittle than the genuine bark.

EFFECTS AND USES.—Slippery-elm bark is a valuable *demulcent*, extensively and advantageously employed in *acute dysentery*, *diarrhœa*, *genito-urinary diseases*, *catarrhs*, etc. It is also highly nutritious. *Externally* it is an excellent emollient application, in the form either of infusion or of poultice made with the powder. It has been also made into a spongy mass, as a tent to dilate the os uteri, as in *dysmenorrhœa*.

ADMINISTRATION.—The infusion—*mucilago ulmi* (*mucilage of slippery-elm bark*) (2 parts to water 100 parts)—may be used *ad libitum.*

SASSAFRAS MEDULLA—SASSAFRAS PITH.

Sassafras pith is the PITH of the stems of Sassafras officinale (*vide* p. 384). It occurs in light, spongy, whitish, slender, cylindrical pieces, of a mucilaginous taste. It abounds in a gummy matter, which it yields readily to water, forming a limpid, viscid mucilage. This *mucilage* (2 parts to water 100 parts)—is a pleasant demulcent drink in *dyspeptic*, *nephritic*, and *catarrhal affections*, and is much used as a soothing application in *ophthalmia.*

ALTHÆA.

The ROOT of Althæa officinalis (*Nat. Ord.* Malvaceæ), commonly known as *Marshmallow*, an herbaceous European plant, occasionally found, too, on the borders of salt marshes in our own country, with ovate, soft, velvety, crenate leaves and pretty flesh-colored flowers, is much used in Europe as a demulcent. The roots of other Malvaceæ are often substituted for those of the official roots.

DESCRIPTION AND CONSTITUENTS.—The roots are imported in pieces, three or four inches in length, of nearly the thickness of the finger, light, easily broken, white externally, of a peculiar faint smell and a mild, mucilaginous, sweetish taste. The chief constituents of marshmallow are *mucilage* and *starch*, the former soluble in cold water, the latter requiring boiling water. It contains also *asparagin* ($C_4H_8N_2O_3.H_2O$), a crystalline principle found in asparagus-shoots and other plants.

EFFECTS AND USES.—Marshmallow decoction is employed as a *demulcent* in inflammatory and irritated conditions of the mucous membranes of the *respiratory*, *digestive* and *urinary organs*, and poultices made of the bruised or powdered root are used externally. The *syrup* is official.

OLEUM SESAMI—OIL OF BENNE.

This is a FIXED OIL EXPRESSED from the SEED of Sesamum indicum (*Nat. Ord.* Pedaliaceæ), an annual plant, growing to the height of four or five feet, with ovate-lanceolate, lobed leaves, reddish-white axillary flowers, and an oblong capsule containing small oval yellowish seeds. It is a native of India, but is now raised throughout Asia and in Egypt and Italy, also in South Carolina and in the neighborhood of Philadelphia. The seed contains a FIXED OIL, and the leaves yield to cold water a large quantity of mucilage resembling that of sassafras-pith.

EFFECTS AND USES.—This is a highly-esteemed *demulcent* drink, used in *cholera infantum* and *infantile bowel complaints.* The seeds are eaten as food by the negroes in Carolina, in broths, puddings, etc. The OIL, which is inodorous, of a bland, sweetish taste, and keeps well may be used *internally* or *externally* as a substitute for olive-oil.

CYDONIUM.

This is the SEED of Cydonia vulgaris or Quince-tree (*Nat. Ord.* Rosaceæ), a native of Europe, but cultivated in the United States for the fruit. The seeds are ovate, angular, reddish-brown externally, white within, inodorous, insipid, and abound in mucilage.

EFFECTS AND USES.—They are used, principally, *externally,* in solution (*mucilago cydonii*), two parts to water 100 parts; but may be given internally as a demulcent, in *gastro-intestinal* or *bronchial inflammations.*

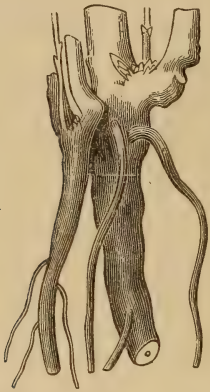
GLYCYRRHIZA.

Glycyrrhiza or Liquorice Root is the ROOT of Glycyrrhiza glabra (*Nat. Ord.* Leguminosæ), a small herbaceous perennial plant, of the countries around the Mediterranean. It is imported from Sicily and Spain; and a portion of the Sicilian root is said to be the product of G. echinata.

DESCRIPTION AND CONSTITUENTS.—As found in the shops glycyrrhiza is in long wrinkled pieces, often worm-eaten, varying from a few lines to more than an inch in thickness, externally grayish-brown, internally yellowish, without smell, and of a sweet, mucilaginous, sometimes slightly acrid taste. The best pieces are of the brightest yellow internally. The powder is grayish-yellow, or, if it be powdered with the epidermis removed, pale sulphur-yellow. The Russian glycyrrhiza of commerce is said to be derived chiefly from G. glandulifera; the root has a reddish tint and a scurfy surface, which distinguish it from the smoother one, G. glabra. The constituents of glycyrrhiza are a peculiar transparent yellow, uncrystallizable sugar, termed *glycyrrhizin*, ($C_{16}H_{24}O_6$) (which is scarcely soluble in cold water, but soluble in boiling water and alcohol, and is a glucoside, splitting up, when warmed with a dilute acid or upon being boiled, into glycyrretin and sugar), *starch*, *asparagin*, an acrid *resin*, etc.

Effects and Uses.—Liquorice root has a sweetish agreeable taste and when chewed increases the flow of saliva. A decoction of glycyrrhiza is a useful demulcent in *dysenteric*, *catarrhal* and *nephritic affections ;* it is also added to decoctions of acrid substances, to cover their taste and acridity. A bit of the extract dissolved in the mouth will allay *hoarseness* and *pharyngeal cough*. It should be made of the root *deprived of its cortical part*, which is acrid and without demulcent virtues; by long boiling the acrid resin is extracted. The powder is used in making pills.

Fig. 58.



GLYCYRRHIZA GLABRA, ROOT.

Administration.—A *fluid extract* is official, and is a useful addendum to cough-mixtures and to disguise the taste of ammonium carbonate or chloride.

Glycyrrhizinum Ammoniatum (*Ammoniated Glycyrrhizin*) is prepared by macerating and then percolating glycyrrhiza with water of ammonia, precipitating with sulphuric acid, washing the precipitate and dissolving in water of ammonia and spreading on glass-plates to dry. It may be used for the same purpose as the other preparations of liquorice.

Extractum Glycyrrhizæ (*Extract of Glycyrrhiza—Extract of Liquorice*).

Preparation and Description.—This is made by the evaporation of a decoction of the half-dried root. It comes to this country chiefly from Leghorn and Messina, and in part, also, from Spain; a good extract is prepared, too, in New York and England. The crude extract, when good, occurs in black, flattened, cylindrical rolls, about an inch in diameter, which are dry, brittle, with a shining fracture, of a very sweet, peculiar, slightly acrid taste, and are quite soluble in water. It is, however, much sophisticated, and for internal use is generally *refined* by dissolving the impure extract in water and water of ammonia, without ebullition, straining the solution and evaporating; sugar is often mixed with it, and sometimes mucilage or glue. *Refined liquorice* (*extractum glycyrrhizæ purum*) is in small cylindrical pieces, not thicker than a pipe-stem.

Effects and Uses.—Liquorice-extract is chiefly employed for pharmaceutical purposes. It is, however, a pleasant demulcent, much used as an addition to cough-mixtures and lozenges and to disguise the taste of acrid infusions, decoctions, turpentine, hyoscyamus, quinine, etc.

Administration.—*Mistura glycyrrhizæ composita* (*compound mixture of liquorice*), commonly called *brown mixture*, consists of the pure extract, acacia, sugar, each 3 parts; paregoric, 12 parts; antimonial wine, 6 parts; sweet spirit of nitre, 3 parts; water, 70 parts; dose, f℥ss; an excellent preparation in the treatment of *bronchitis* without fever. Liquorice-extract enters into the composition of several *troches* already noticed, and it is used as an excipient for pills.

LYCOPODIUM.

This is the sporules of Lycopodium clavatum or Club-moss, and other species of Lycopodium (*Nat. Ord.* Lycopodiaceæ), low, creeping perennials, found in the dry woods of Europe and America.

Description and Constituents.—The stem is from 2 to 4 feet long, with numerous short ascending branches, having linear awl-shaped leaves; the sporules are found in reniform sporangia of the long peduncle which terminates the fertile branches. It consists of a fine, yellow, inflammable powder; odorless, tasteless, and not wetted by water, and contains *fixed oil* and *volatile bases.*

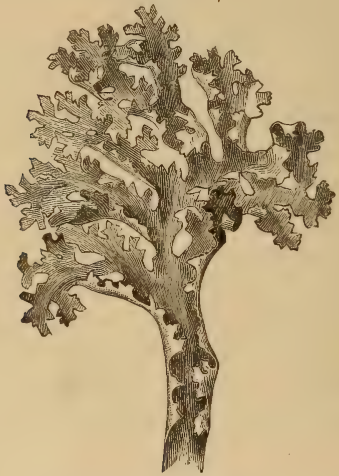
Effects and Uses.—It is employed as a dusting powder, and, as it is not wetted by water, makes an excellent application for *excoriated surfaces*, *intertrigo*, etc. It is particularly useful to prevent the *irritation* or *chafing* caused by the urine or alvine dejections coming in contact with the tender or inflamed perinæum and nates, in infantile cases.

It is also used in pharmacy to prevent the adhesion of pills.

CETRARIA.

Cetraria islandica, or Iceland Moss (*Nat. Ord.* Lichenes), is a foliaceous, erect lichen, from two to four inches high, found in the northern latitudes and mountainous districts of the new and old continents. It is obtained principally from Norway and Iceland, but is said to be abundant also in New England.

Fig. 59.



CETRARIA ISLANDICA.

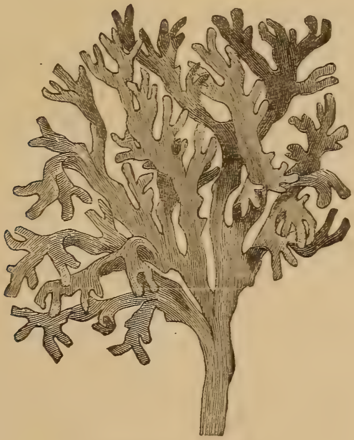
Description and Constituents.—As found in the shops it consists of irregularly-lobed and channelled coriaceous leaves, fringed at their edges with rigid hairs, of a brownish or grayish-white color, darker on the upper surface, and sometimes marked with blood-red spots. It is almost odorless, and has a bitter, mucilaginous taste; its powder is whitish-gray. It gives up its virtues to boiling water, and consists chiefly of a kind of amylaceous matter (which is colored blue by iodine, and is termed *lichenin*—$C_{12}H_{20}O_{10}$), and a bitter principle termed *cetrarin* or *cetraric acid* ($C_{18}H_{16}O_8$); it contains, besides, other principles.

Effects and Uses.—Iceland moss is a *demulcent* tonic, and is also highly nutritious. It is adapted to cases requiring a light aliment combined with a mild and acceptable tonic; and from its demulcent properties has a soothing influence in inflammations of the various mucous membranes. It is chiefly used in *chronic affections of the pulmonary and digestive organs*, as *bronchitis* and *diarrhœa*, in the form of *decotion* (*decoctum cetrariæ*), which may be taken *ad libitum*. By maceration in water or a weak alkaline solution, Iceland moss may be deprived of its bitter principle; and it is then used as a mild nutritive demulcent.

CHONDRUS.

Chondrus crispus, Carrageen or Irish Moss (*Nat. Ord.* Algæ), is a marine alga found chiefly on the west coast of Ireland, and also on the coast of New England. It is also obtained from Chondrus mammilosus.

Fig. 60.



CHONDRUS CRISPUS.

Preparation, Description and Constituents.—It is prepared for use by washing, bleaching, and drying. As found in the shops it consists of fronds from two to three or four inches long, mostly yellowish or dirty-white but intermixed with purplish-red portions, nearly inodorous, and of a mucilaginous taste. It swells up in warm water, and is almost entirely dissolved when boiled. Its chief constituent is a peculiar mucilaginous principle, for which the term *Carrageenin* has been proposed; and it contains also some mucus, resins, etc.

Effects and Uses.—It is a very agreeable nutritive *demulcent*, useful in *bowel complaints and pectoral affections.*

Administration.—It may be given in the form of decoction (℥ss to water Ojss boiled to Oj) flavored with lemon-juice and sugar; or it may be made with milk or cream into *blanc-mange*, which forms an excellent light diet for the sick. By saturating two superimposed layers of wadding with a solution of chondrus, and drying them in a stove after they have been submitted to a strong pressure, a sheet of the consistence of card-board is produced, which, when soaked in hot water, makes an excellent *poultice.*

AMYLUM—STARCH.

This term is applied by the Pharmacopœia to the FECULA of the SEED of Triticum vulgare, the well-known wheat (*Nat. Ord.* Graminaceæ). It is a proximate principle, however, which pervades the vegetable kingdom, being found in various parts of plants, especially in seeds, tubers and bulbous roots.

Preparation, Microscopical Appearance and Tests.—It is obtained by bringing the substances in which it exists to a state of minute division, agitating or washing them with cold water, straining or pouring off the liquid, and allowing it to stand until the fecula which it holds in suspension has subsided. It occurs as a white, opaque, odorless, tasteless, powder, or in columnar masses of a crystalline aspect, and produces a peculiar sound when compressed between the fingers. It is insoluble in alcohol, ether, and cold water. Examined under the microscope, starch is seen to consist of minute circular or lenticular granules, the laminæ of which are arranged around a central point or hilum, varying in size and shape in the different varieties of amylaceous substances. The diameter of the wheat granule is about $\frac{1}{1000}$ of an inch. The potato-starch granule is one of the largest, that of rice the smallest. The *envelope* of these granules is insoluble in *cold* water, but is ruptured by heat, so that the interior portion is exposed and becomes dissolved; hence starch is said to be insoluble in cold, but soluble in boiling water. Starch is $C_6H_{10}O_5$, and is classed with the carbohydrates. By the action of heat, or by long boiling with diluted sulphuric or hydrochloric acid, it is converted into *dextrin*, an isomeric soluble principle, and by the same process this may be converted into grape-sugar. The same change takes place in grains, after germination, through the agency of a nitrogenous principle termed *diastase*. The *test* for starch is iodine, which forms with starch-solution a rich blue iodide; nitric acid converts it into oxalic acid.

EFFECTS AND USES.—The starchy or farinaceous articles form an important group of nutrients. Their assimilation is effected by the albuminous principles of the digestive tube (salivin and pancreatin), which change starch into grape-sugar, the conversion taking place in the mouth and duodenum. Starch is used externally as a dusting powder to *excoriated surfaces;* to prevent *chafing* (starch 10 parts, salicylic acid 3, and powdered soap-stone 8); to *prickly heat* with zinc oxide; as an *emollient poultice*, and in solution as a vehicle for laudanum in the form of *enema*. It is the antidote for iodine.

Glyceritum Amyli (*Glycerite of Starch*) (*Plasma*) contains 10 per cent. of starch thoroughly mixed with glycerin and dissolved by the aid of heat. It is excellent as a vehicle for astringent applications in ophthalmic surgery, and as an application to allay heat, burning and itching of the skin in *scarlatina* and *smallpox*; in the latter it is particularly pleasant to the patient, and has as much effect in preventing pitting as any other application. It is used as a substitute for ointments, and is a good excipient for pills. *Amylum iodatum* (*iodized starch*) has been already spoken of (*vide p.* 452.)

Ichthyocolla (*Isinglass*), prepared from the *swimming bladder* of Acipenser Huso (the sturgeon) and of other species of Acipenser (*Class*, Pisces; *Ord.*, Sturiones) is the purest form of gelatin. *Court-plaster* (*Emplastrum ichthyocollæ*) is made by coating thin silk with a solution of isinglass. *Gelatin* is also used as an article of diet, and is employed in pharmacy to make capsules for the administration of disagreeable medicines, and as a coating for pills.

For *external use*, the ANIMAL FATS are employed as *emollients*. When applied *externally*, they are absorbed and assimilated, and increase the body-weight; hence inunctions have been practiced in wasting diseases, as *phthisis*, etc. They also reduce the temperature of the body in febrile conditions, and allay itching and irritation of the surface, and for this purpose they are employed in the exanthemata, as *scarlet fever*, *measles*, etc. They are also used as excipients for other medicines, in making ointments, etc.

Adeps (*Lard*) is the PREPARED FAT of Sus Scrofa (the hog) (*Class*, mammalia; *Ord.*, pachydermata); the internal fat of the abdomen is preferred, which is washed, melted and strained. Below the temperature of 90° it occurs as a soft, white solid, which for medicinal use should be free from saline matter. It consists of olein and stearin.

EFFECTS AND USES.—It is used in pharmacy as an addition to poultices, and as an inunction in the exanthemata, particularly *scarlatina* and *measles*.

ADMINISTRATION.—*Cerate* (*ceratum*) is made by melting together 70 parts of lard and 30 parts of white wax. *Unguentum* (*ointment*) is made by melting together 80 parts of lard and 20 parts of yellow wax. *Lard-oil* (the olein of lard) is a good vehicle for anodyne-enemata.

Adeps benzoinatus (*benzoinated lard*), formerly termed *benzoinated ointment*, consists of benzoin 2 parts in 100 parts of lard.

Lanolin (not official). This substance, the description of which is based on the investigations of Liebreich* (by whom it was introduced), Lassar,† Aubert,‡ W. G. Smith,§ and Kinner,‖ is the purified fat of sheep's wool; chemically, it is a fatty salt of cholesterin. It is not a secretion of the sebaceous glands, but a retrograde metamorphosis of keratin. It is neutral, of slight odor, dark color, not readily decomposed, blends easily with glycerin and fats, has considerable capacity for mixing with water, and is not saponifiable.

LOCAL EFFECTS.—Lanolin when applied to the skin acts as a bland lubricant. Liebreich (*loc. cit.*) states that corrosive sublimate mixed with lanolin and brought in contact with the skin soon produces a metallic taste in the mouth. Lassar (*loc. cit.*) has shown, too, that cinnabar mixed with it penetrates more deeply into the skin than with other ointments. Aubert (*loc. cit.*), on the other hand, affirms that he was unable to obtain the constitutional effects of atropine in lanolin rubbed on the skin; in fact, he considers it retards, rather than accelerates, absorption. The weight of experience, however, now shows that it possesses considerable penetrative power.

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* *Berlin Klinische Wochen.*, No. 47, p. 761.

† *Ibid.*, No. 5, p. 75.

‡ "*Congrès de Chirurgie*," Paris, 1886, quoted.

§ *Brit. Med. Jour.*, 1886, p. 1106.

‖ *Journ. of Cutaneous and Venereal Diseases*, 1886, p. 270.

MEDICINAL USES.—It is an excellent excipient with which to apply medicines to the skin; to assist the removal of scales, as in *psoriasis;* to lubricate the cracks and fisures of *eczema* after the acute stage has been passed, and, in fact, wherever in the use of an unirritating, undecomposable ointment is indicated. It may be diluted with other fats and flavored with oil of lavender.

Sevum (*Suet*) is the INTERNAL FAT OF THE ABDOMEN of Ovis Aries (the sheep) (*Class*, Mammalia; *Ord.*, Ruminantia), purified by melting and straining. It is composed almost exclusively of stearin, but also contains some palmitin, olein and hircin.

Cetaceum (*Spermaceti*) is a peculiar CONCRETE FATTY SUBSTANCE obtained from Physeter macrocephalus or spermaceti whale (*Class*, Mammalia; *Ord.*, Cetacea). It consists almost entirely of *cetyl palmitate* ($C_{16}H_{33}C_{16}H_{31}O_2$) or *cetin*, but recently has been shown to contain also *ethers of stearic*, *myristic* and *laurostearic acids;* and of the *alcohols*, *lethal* ($C_{12}H_{26}O$), *methal* ($C_{14}H_{30}O$), *ethal* ($C_{16}H_{34}$) and *stethal* ($C_{18}H_{33}O$). *Spermaceti cerate* (*ceratum cetacei*) is made by melting together 10 parts of spermaceti and 35 parts of white wax, and then adding 55 parts of olive-oil, previously heated. Ointment of rose-water (see p. 195) contains spermaceti.

Cera Flava (*Yellow Wax*) is a peculiar CONCRETE SUBSTANCE prepared by Apis mellifica, the honey-bee (*Class*, Insecta; *Ord.*, Hymenoptera).

Cera Alba (*White Wax*) is yellow wax bleached. They are used chiefly in making cerates, ointments and plasters.

ACIDUM OLEICUM—OLEIC ACID.

Oleic acid ($HC_{18}H_{33}O_2$) exists in nature combined with glycerin and olein.

PREPARATION AND DESCRIPTION.—It is obtained in an impure state as a secondary product at stearin-candle manufactories. To purify the acid, it is cooled to 14°F. and expressed; the solid portion melted and treated with lead protoxide; the lead oleate is dissolved out by ether, decanted, and shaken with hydrochloric acid, which decomposes it; the ethereal layer is decanted and evaporated. The oleic acid thus obtained is still contaminated with a little oxyoleic acid, which is difficult to separate. Oleic acid is a yellowish oily liquid, which becomes brownish and rancid by exposure to the air, without smell or taste, soluble in alcohol and ether, but insoluble in water.

EFFECTS AND USES.—Oleic acid penetrates or soaks through the skin more readily than do the oils or fats. It is consequently employed as a vehicle in cutaneous medication, particularly in the form of the oleates. The oleates of the alkaline metals are soft soluble soaps; those of the earthy metals are insoluble in water, but soluble in alcohol and ether.

Oleic acid is used principally in preparing the *oleates of veratrine* (*vide* p. 246) and *of mercury* (*vide* p. 434). Oleates of copper and zinc are also employed.

OLEUM THEOBROMÆ—OIL OF THEOBROMA.

This oil, commonly known as *Butter of Cacao*, is the FIXED OIL EXPRESSED from the SEED of Theobroma Cacao (*Nat. Ord.* Sterculiaceæ), a handsome tree, from twelve to twenty feet in height, growing in Mexico, the West Indies, Central America and South America. The fruit is an ovate-oblong capsule or berry, half a foot in length, with a thick, coriaceous, ligneous rind, inclosing a whitish pulp, in which numerous ovate seeds are embedded, about the size of an almond. Separated from the matter in which they are enveloped, these constitute the *chocolate-nuts* of commerce (see p. 130). They contain FIXED OIL (*cacao butter*), *theobromine*, and other matters. *Theobromine* is an alkaloid, analogous to caffeine.

PREPARATION AND DESCRIPTION.—*Cacao-butter* is obtained by expression, decoction or the action of a solvent. It occurs in whitish or yellowish oblong cakes, of the consistence of tallow and of an agreeable odor and taste. It contains a large proportion of stearin, also palmitin and olein.

EFFECTS AND USES.—It is employed in pharmacy for coating pills, and also largely in preparing suppositories, for which it is well adapted by reason of its consistence and blandness, and because it melts at the temperature of the body. It does not become rancid on exposure to the air. It may be used with advantage as an unguent in *fever*, to reduce the heat and allay the cutaneous irritation.

GLYCERINUM—GLYCERIN.

This is a substance which exists in oils in combination with the fatty acids (stearic, margaric, oleic, etc.), and is liberated from them when they unite with bases in the process of saponification.

Preparation.—It was first obtained in the process for making lead-plaster, by mixing litharge (lead monoxide) with olive-oil and boiling water, by which the fatty acid unites with the lead and is precipitated, and the glycerin remains in solution. It is freed from any lead it may contain by means of a stream of sulphuretted hydrogen gas, and is afterward filtered through animal charcoal; or, as it is now usually made more directly, by decomposing fats and distilling by steam under high pressure. Glycerin (C_3H_53HO), or Glyceric Alcohol, is the hydrate of *Glyceril*, *Glycil*, or *Propenyl*, and is a triatomic alcohol.

Description.—It is a thick, syrupy liquid, colorless or straw-colored, unctuous to the touch, inodorous, of a sharp, sweet taste, and of neutral reaction. When pure its sp. gr. is 1.260, when it contains 95 per cent. of absolute glycerin; the Pharmacopœia directs its sp. gr. to be 1.250. It is soluble in alcohol and water, but is insoluble in ether and chloroform, and does not evaporate when exposed to the air, but absorbs one-half its weight of water. It readily reduces potassium permanganate, with which it is incompatible. It has remarkable solvent properties, dissolving iodine, bromine, the alkalies, tannic and other vegetable acids, pepsin, a large number of neutral salts, and many organic principles. Official solutions of medicinal substances in glycerin are termed *glycerites* (*glycerita*).

Effects and Uses.—Glycerin is a bland and unirritating substance. It has the capacity of diffusing itself freely over and through organic matter, incorporating itself between organic molecules, by which it is absorbed and appropriated. It has been used *internally* as a demulcent, but the weight of opinion is against its efficacy as a nutrient. It is as a *topical* application that it is chiefly employed. As an enema in *dysentery;* to soften hardened mucus in the upper air-passages, as in *chronic nasal catarrh;* in various cutaneous affections, as *chaps;* in *deafness* attended with dryness of the meatus; and as a vehicle or solvent for active medicines, glycerin is a valuable article. In gynæcological practice the introduction of a pledget of cotton soaked in glycerin within the vagina as far as the cervix is followed by a watery discharge which relieves neighboring congestion, and hence is an agent of some value in mild *metritis;* or equal parts of carbolic acid and glycerin may be applied to the uterine cavity. Guzzo[*] recommends the following treatment to prevent extensive cicatrization following *burns* and *scalds:* apply to the entire burned surface a piece of lint thickly spread with cold cream and covered with a compress two inches thick saturated with glycerin (freshly wet from three to six times a day; the whole dressing to be changed daily), and covered with a dry compress and bandage. This treatment failed in only one of fifty-one cases.[†]

Recently attention has been called to small *rectal injections of glycerin* (fʒ½–j) as a safe, sure, and speedy means of opening the bowels in *obstinate constipation.* It seems to act by irritating the sentient rectal nerves, leading to powerful reflex peristalsis, which ends in defecation (Althaus,[‡] Anacher[§] and Mayer[||]). The liquid may be introduced by a urethral rubber-syringe.

Glyceritum amyli (*glycerite of starch*) has already been considered (*see* p. 573).

Glyceritum vitelli (*glycerite of yolk of eggs*) (*glyconin*) is made by mixing thoroughly 45 parts of fresh yolk of egg with 55 parts of glycerin. It is a good vehicle for the administration of cod-liver oil, a few drops of some aromatic being added as a flavoring ingredient.

PETROLATUM.

Petrolatum is a mixture of hydrocarbons obtained by distilling the lighter and more volatile portion from American petroleum, and purifying the remainder. Mineral oils have been known from time immemorial, and were obtained by the ancients from Sicily, the Ionian Islands and Persia; later they were found in various parts of Europe, Asia and North America, but did not become an important article of commerce until 1859, when the first oil-well was sunk near Titusville, in Pennsylvania.

DESCRIPTION AND CHEMISTRY.—Petrolatum is a yellowish, transparent, semi-solid fatty substance, melting at from 104° to 124° F., insoluble in water and cold alcohol, more so in boiling absolute alcohol; readily soluble in ether, chloroform, oil of turpentine, benzine, and the fixed and volatile oils. It consists principally of the hydrocarbons of the marsh-gas series. It has been introduced into the Pharmacopœia as a substitute for *vaseline*, *cosmoline*, and other copyrighted preparations, which consist of mixtures of *paraffine* and the heavier petroleum oils, and, like them, possesses the advantage over the animal oils and fats of not becoming rancid.

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[*] *Gaillard's Med. Journ.*, March, 1882.

[†] *Arch Dermat.*, Oct., 1882.

[‡] *Brit. Med. Journ.*, Dec. 24, 1887, p. 1379.

[§] *Deuts. Med. Wochen.*, Sept. 15, 1887, p. 823.

[||] *Med. News*, Feb. 25, 1888, p. 201.

EFFECTS AND USES.—When taken *internally*, in large doses, petrolatum is said to cause giddiness and oppression, with palpitation and headache. It seems to be well borne by the stomach, and causes no diarrhœa. It is employed only *externally* as an inunction in *scarlet fever*, *measles*, *roseola*, and *cutaneous affections* such as *lichen* and *chaps*, to *blistered surfaces*, and it forms an admirable basis or excipient for ointments and drugs. It is an excellent dressing for *abrasions* mixed with carbolic acid gr. v–x to ℥j.

A liquid paraffine (*oleum petrolati*, not official), pure, or as a solvent for menthol (gr. ij to ℥j), camphor, etc., is used as a nasal or pharyngeal spray.

PYROXYLINUM—PYROXYLIN.

PREPARATION.—**Pyroxylin**, or **Soluble Gun Cotton**, is made by adding cotton (cellulin) to a mixture of nitric acid gradually added to sulphuric acid, and allowing it to macerate; it is to be washed first with cold water, and then with boiling water, and after being drained on filtering paper it is dried by means of a water-bath.

CHEMISTRY.—Cellulin is ($C_6H_{10}O_5$) which when treated with (HNO_3) and (H_2SO_4) is converted into dinitro-cellulose by the substitution of 2 molecules of nitril (NO_2) for 2 atoms of its (H) forming pyroxylin. Pyroxylin has the appearance of ordinary cotton, but is harsh to the touch. It is insoluble in water and alcohol, but, when *freshly* prepared, it dissolves in ether, forming collodion; it is liable to *decomposition* if kept for some time.

COLLODIUM--COLLODION.

PREPARATION.—This is a solution of pyroxylin (4 per cent.) in stronger ether (70 per cent.) and stronger alcohol (25 per cent.). Collodion is a slightly opalescent, syrupy liquid, with a strong ethereal smell. By long standing it deposits a layer of fibrous matter, and becomes more transparent; this layer should be reincorporated by agitation before the collodion is used.

EFFECTS AND USES.—When applied to the skin the solvent evaporates, and it forms a colorless, transparent, flexible and strongly contractile film. This film proves antiphlogistic by driving the blood away from a part, limiting effusion and promoting absorption, and at the same time acts as an admirable emollient by protecting an inflamed surface from the action of the air.

It is a *useful* application to *ulcers*, *fissures* and *skin-diseases* and *abraded surfaces.* Marked improvement has followed its daily use in that disfiguring keloid of the face which sometimes follows *small-pox.* It is employed also in surgery as a substitute for adhesive plaster, and in pharmacy as a vehicle for other medicines. *Iodized collodion* (a very good solution of iodine for external application) contains from ten to twenty grains of iodine in a fluidounce of collodion. It has been recently applied to the scalp with success in functional *alopecia.*[*] Collodion f℥½ and morphia sulphate gr. ij–v is a useful application to *herpes zoster.*

Collodium Flexile (*Flexible Collodion*) is made by mixing 92 per cent. of collodion, 5 per cent. of Canada turpentine and 3 per cent. of castor-oil. This is a softer, more pliable and more elastic preparation, useful in cases where the strongly contractile power of ordinary collodion is objectionable. It is a good application in *eczema* and *excoriations.* Collodion, in all forms, is to be kept in well-stoppered bottles.

Collodium Stypticum (*Styptic Collodion*) contains 20 per cent. of tannic acid, 5 per cent. of alcohol, 20 per cent. of stronger ether and 55 per cent. of collodion. It is an excellent styptic application.

LIQUOR GUTTA-PERCHÆ--SOLUTION OF GUTTA-PERCHA.

This is a solution of 9 per cent. of gutta-percha in 91 per cent. of commercial chloroform. In preparing it lead carbonate is employed to free it from coloring matter. It is a clear, colorless or nearly colorless solution, and should be kept in well-stoppered glass-vials. By the evaporation of the chloroform, this proves an admirable application to *inflamed* or *abraded parts*, in *skin-affections*, *chaps*, etc.; it is also an excellent protective coating to parts threatened with *bed-sores* or liable to *excoriations*, and for the retention of medicinal substances upon the skin in dermal therapeutics, as chrysarobin (q. v.) to *ringworm.*

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[*] *Brit. Journ. of Dermatology*, July, 1892.

LIQUOR SODII SILICATIS—SOLUTION OF SODIUM SILICATE.

Preparation and Description.—This solution (commonly known as *Solution of Soluble Glass*) is made by fusing together fine sand and dried sodium carbonate, and dissolving the product in hot water. It is a semi-transparent, colorless, viscid liquid, without smell but having a sharp, alkaline taste, which, on drying, becomes a transparent glass-like mass.

Effects and Uses.—It has been employed as a local application in erysipelas, but is chiefly used in making permanent dressings in the treatment of *fracture.* For this purpose it should be applied upon a roller bandage thoroughly impregnated with the sodium silicate of the consistency of mush, freshly prepared in a basin, with a little water. The parts, if hirsute, should be shaved; and to prevent too much pressure upon the superficies it is well to first apply a flannel-bandage. Successive layers of the plaster-bandage are then applied and allowed to harden. Generally three or four layers will be sufficient. Inequalities in the dressing may be filled in by smearing on the moistened silicate.

SACCHARUM—SUGAR.

Sugar is a principle diffused through the vegetable world under many forms, all distinguished by a sweet taste. They are divided into two chief groups—*Cane-Sugar* and *Grape-Sugar.* Cane-sugar is the product of Saccharum officinarum (*Nat. Ord.* Graminaceæ), a native of tropical countries, cultivated most successfully in the West Indies, the Sandwich Islands, and to some extent in Louisiana. It has a general resemblance to Indian corn.

Preparation.—The juice of the sugar-cane is extracted by crushing and expressing the stalks; it is then boiled with quicklime, strained, and reduced by evaporation to a thick syrup, which is cooled and granulated in shallow vessels. *Raw* sugar is *refined* by the agency of animal charcoal. Cane-sugar is also made in France and Belgium from the beet-root. When pure, cane-sugar is white, crystallized in translucent, double oblique prisms, very sweet, soluble in one-third its weight of water, in alcohol, but not in ether. At a heat of 220° F. it melts and cools into a glassy, amorphous mass, known as *barley-sugar;* from a strong solution it can be made to crystallize slowly upon a string as *rock-candy.*

The uncrystallizable portion, which is drawn off in the granulation of sugar is *molasses* or *treacle*, a dark brownish-black, syrupy liquid.

Grape-sugar is the sugar of grapes and other acid fruits; it is also found in the liver and blood of mammalia, and in the urine of diabetes mellitus. It may be procured artificially by acting on starch with diluted sulphuric acid. It occurs as whitish or grayish-white, non-crystalline masses, or as a dense transparent syrup.

Chemistry.—Cane-sugar ($C_{12}H_{22}O_{11}$) combines with alkalies to form saccharates. Nitric acid with heat converts it into oxalic acid. Grape-sugar ($C_6H_{12}O_6.H_2O$), when boiled with an alkali, is transformed into the acid of molasses, melassic acid; mixed with solution of potassium hydrate and a weak solution of cupric sulphate, it attracts oxygen, and causes the precipitation of a reddish, cuprous oxide (Cu_2O).

Effects and Uses.—Sugar, especially in the form of barley-sugar, is an excellent demulcent to relieve *catarrhal irritation;* much of the cough-relieving action of cough-syrups is due to the sugar they contain. It abates thirst, and is used to flavor refrigerant drinks. For pharmaceutical purposes sugar is much employed, for its agreeable taste, and also as a preservative of vegetable substances, and to protect mineral medicines from oxidation. Molasses is slighly laxative as well as demulcent.

Mel (*Honey*). This *saccharine* liquid, the familiar product of the bee (*Apis Mellifica*), best used in the form of *mel despumatum* (*clarified honey*), is a slightly laxative article of food, and is used in pharmacy, and as an agreeable demulcent ingredient in gargles.

Saccharum Lactis (*Sugar of Milk*) ($C_{12}H_{22}O_{11}.H_2O$), the saccharine principle of milk obtained from whey, is used as a bland non-nitrogenous article of diet. It is used in preparing *abstracts* and to insure the admixture of powders, as in *pulvis ipecacuanhæ et opii.*

SACCHARIN* (NOT OFFICIAL).

Chemistry.—This, a recently introduced therapeutic agent, is a product of the coal-tar derivatives, being derived from the aromatic group of hydrocarbons, and is chemically anhydro-orthosulphaminbenzoic acid (Fahlberg†). It is a white, crystalline powder, unalterable at ordinary temperatures, of an acid reaction, slightly soluble in cold water, dissolves in alcohol, glycerin and ether, and unites with the alkalies to form definite salts. Its most characteristic property is *sweetness*, saccharin being in this respect about 300 times greater than that of cane-sugar.

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* *Brit. Med. Journ.*, Oct. 16th, 1887.

† *Amer. Chem. Journ.*, 1879; Vol. 1, p. 436.

Effects and Uses.—When taken *internally*, even in large quantity (ʒss–gr. lxxx), it is innocuous. Dogs fed on it together with their ordinary diet, according to Égasse,* did not increase in weight, nor was any alteration either in the quantity, specific gravity, or proportion of urea in their urine, found. It passes through the economy undecomposed, since it can be detected in the urine unchanged, but it has not been discovered in the saliva or feces. In its exit by the kidneys it exerts a decided influence in restraining the alkaline fermentation of the urine, hence it has proved valuable to correct the fetor of the urine in *chronic cystitis*.

It is chiefly *employed* as a substitute for sugar in *obesity*, and in *diabetes mellitus*, gr. j–ij being sufficient to sweeten the tea, coffee, sugar or food; and as a corrective of the taste of certain bitter medicines, as quinine (*see* p. 158).

ORDER IV.—COLORING AGENTS.

These are employed exclusively for pharmaceutical purposes. The following articles enter into official preparations, to which they are intended to communicate their peculiar color:—

CROCUS—SAFFRON.

This is the STIGMAS of Crocus sativus (*Nat. Ord.* Iridaceæ), a small perennial plant, a native of Greece and Asia Minor, but now cultivated all over Europe and in our own country. In Lancaster county, Pennsylvania, it has been raised to considerable extent.

Description and Constituent.—The stigmas are an inch or more in length, of a rich deep orange color, a peculiar aromatic odor and a warm, pungent, bitter taste; they contain a principle termed *saffranin* or *polychroit* ($C_{48}H_{60}O_{18}$).

Effects and Uses.—Saffron is now admitted to possess little, if any, medicinal activity, and is used only to impart color and flavor to official preparations. The *tincture* contains 10 per cent. of saffron.

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* *Bull. Gén. de Thérap.*, Oct. 30th, 1888, p. 337; an elaborate article.

SANTALUM RUBRUM—RED SAUNDERS.

This is the WOOD of Pterocarpus santalinus, a large tree of India and Ceylon (*Nat. Ord.* Leguminosæ).

DESCRIPTION AND CONSTITUENTS.—It comes in roundish or angular billets, internally of a blood-red color, externally brown, of little smell or taste; in the shops it is found in the form of chips, raspings or coarse powder. It contains a resinoid matter, *santal* ($C_8H_6O_3$), *pterocarpin* ($C_{17}H_{16}O_5$) and *santalic acid.*

EFFECTS AND USES.—It is *employed* solely to give color to spirits, tinctures, etc.

COCCUS-COCHINEAL.

This is an insect, termed Coccus cacti (*Class,* Insecta; *Ord.* Hemiptera), of Mexico and Central America, naturalized in Teneriffe and other places.

DESCRIPTION AND CONSTITUENT.—The *female* insect, *dried,* constitutes the article of the shops. It occurs in the form of roundish or somewhat angular grains, about an eighth of an inch in diameter, convex on one side, concave or flat on the other, and wrinkled. Two varieties are distinguished, one reddish-gray, the other nearly black, known as *silver* grains and *black* grains. It has a faint, heavy odor and a bitter, slightly acidulous taste; its coloring principle is *carminic acid* ($C_{17}H_{18}O_{10}$).

EFFECTS AND USES.— It is *employed* chiefly to color tinctures, ointments, etc.

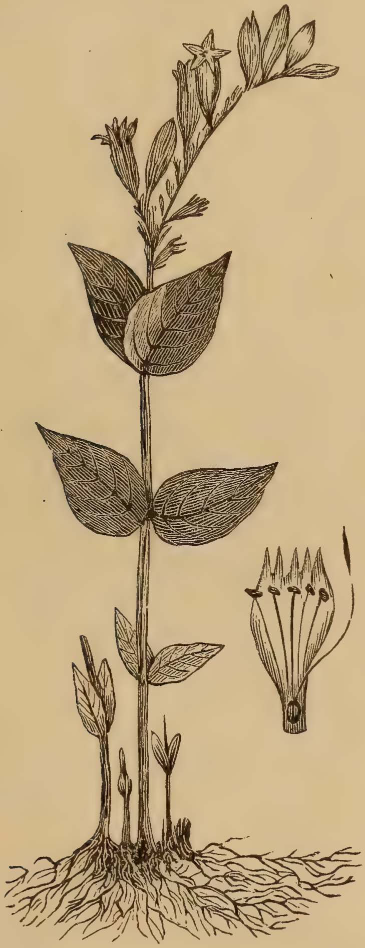
ORDER V.—ANTHELMINTICS.

Anthelmintics are medicines which promote the destruction and expulsion of worms from the alimentary canal. When a medicine simply causes the expulsion of the parasite it is called a VERMIFUGE; when it causes the death of the worm, a VERMICIDE. The *vermifuges* are *spigelia, azedarach, calomel* and the *drastic purgatives;* the *vermicides, chenopodium, santonica, aspidium, granatum, oleum terebinthinæ, koosso, kamala* and *pepo.* They act in different ways; some weaken or destroy the worms by a direct poisonous influence, as male-fern, and others by mechanical means, kamala for example. The drastic cathartics exert an anthelmintic effect by the increased peristalsis and purgation which they induce in and from the intestinal canal. As thread-worms chiefly occupy the rectum, enemata are used to destroy them, as quassia infusion (q. v.), cod-liver oil (q. v.), and carbolic acid (q. v.).

SPIGELIA.

Spigelia, called also Pinkroot, is the RHIZOME and ROOTLETS of Spigelia marilandica, or Carolina Pink (*Nat. Ord.* Loganiaceæ), an herbaceous indigenous plant, found chiefly in our Southern and Southwestern States.

FIG. 61.



SPIGELIA MARILANDICA.

Description and Constituents.—The rhizome is horizontal, thick, bent, purplish-brown, branched on the upper side with cup-shaped stars, on the lower numerous thin, brittle, light-colored rootlets. It must not be confounded with the underground portion of the Phlox carolina, also called Carolina pink. The stems are numerous, from a foot to a foot and a half high, of a purplish color, furnished with sessile, opposite, ovate-lanceolate leaves, and terminate in spikes, bearing funnel-shaped flowers, of a rich carmine color externally and orange-yellow within, which appear from May to July. The rhizome and rootlets, as found in the shops, consist of numerous slender, wrinkled, branching, brownish fibres attached to a dark-brown caudex, and have a faint, peculiar smell and a sweetish, slightly bitter taste; their activity is diminished by time. Boiling water extracts its virtues, which are thought to depend upon a *bitter-principle;* it contains also *volatile oil*, *resin*, a little *tannic acid*, etc.

Physiological Effects.—In ordinary doses spigelia often proves *anthelmintic* without any sensible effect on the system. In larger doses it purges and sometimes vomits; and in excessive doses it operates as a narcotic, producing vertigo, dilated pupils, flushing of the face, etc. The following results were obtained by Hare* with spigelia on dogs. Three ounces of the fluid extract caused constant retching, pupillary dilatation, internal strabismus, rapid respiration, progressive muscular palsy, coma and death. Injected into the veins it slowed the heart's action, the retardation being chiefly due to central inhibitory stimulation. As death approaches, its depressing action on the respiratory centre is marked. It is less apt to occasion narcotic effects when it acts on the bowels, and hence it is usually combined with or followed by cathartics.

Medicinal Uses.—As an anthelmintic against *lumbrici* (or round-worms) it is considered one of the most reliable articles we possess. Before its exhibition a restricted diet and an active cathartic should be prescribed.

Administration.—Dose of the powdered root, ʒj–ij for an adult; for a child three or four years old, gr. x–xx to be repeated night and morning for three or four days, and followed by a brisk cathartic; calomel is sometimes combined with it. The *fluid extract* may be given in the dose of fʒj or more; to a child two years old, ten drops may be given. Under the name of *worm-tea*, preparations containing spigelia and cathartics are kept in the shops, as in the following formula: spigelia, ℥ss; manna, ℥j; senna and fennel, each ʒij; savine, gr. xl; to be infused in Oj of boiling water, and f℥ss given to a child two years old, t. d.

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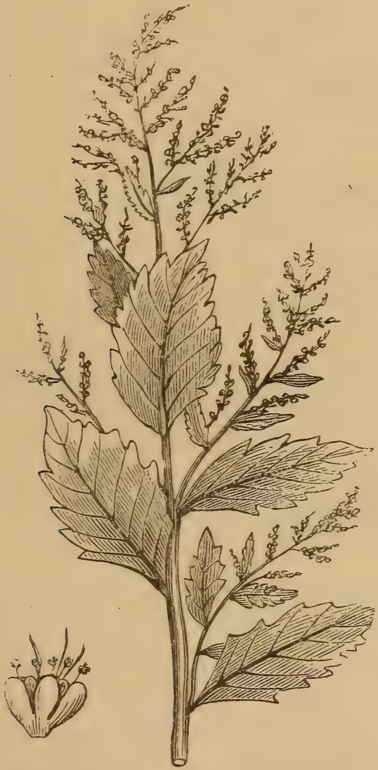
* *Med. News*, March 12, 1887.

CHENOPODIUM.

Chenopodium, or American Wormseed, is the FRUIT of Chenopodium ambrosioides, or Jerusalem Oak (*Nat. Ord.* Chenopodiaceæ), an indigenous, herbaceous, perennial plant (found most abundantly in the Southern States), from two to five feet high, with alternate oblong-lanceolate, sinuated and toothed yellowish-green leaves, with numerous small flowers of the same color arranged in long terminal panicles.

FIG. 62.



CHENOPODIUM AMBROSIOIDES.

DESCRIPTION AND CONSTITUENTS.—Chenopodium, as found in the shops, is in small spherical grains, not larger than a pin's head, of a dull greenish-yellow or brownish color, a peculiar offensive smell, and a rather aromatic, pungent taste. Their sensible and medicinal properties are owing to a VOLATILE OIL (*Oleum Chenopodii*), obtained by distillation.

EFFECTS AND USES.—Chenopodium is a very efficient *anthelmintic*, particularly adapted to the expulsion of *lumbrici* from children.

ADMINISTRATION.—Dose, gr. xx–xl for a child two or three years old, in molasses, night and morning, for three or four days, to be followed by a brisk cathartic. The *oil* is more used than the fruit; dose, gtt. v–x for a child, in emulsion with sugar or in capsules. The expressed juice of the leaves and a decoction made with milk are also used.

SANTONICA.

The unexpanded FLOWER-HEADS of Artemisia maritima (*Nat. Ord.* Compositæ), a native of Persia, and of other species of artemisia, are used as an *anthelmintic* (in the dose of gr. x–xxx), under the name of *Levant Wormseed.*

DESCRIPTION AND CONSTITUENTS.—They resemble small seed in appearance, are about a line in length, oval, obtuse at both ends, of a greenish-brown color, a strong, somewhat terebinthinate odor, and a bitter, camphoraceous taste. They contain *volatile oil*, *resin*, and a peculiar principle termed *santonin*, which is prepared by digesting santonica and lime in diluted alcohol, adding acetic acid, crystallizing, boiling with alcohol, digesting the tincture with animal charcoal, filtering and crystallizing.

Santoninum (*Santonin*) is a neutral principle ($C_{15}H_{18}O_3$), and occurs in colorless, shining, flattened prisms, without smell, nearly tasteless at first, but after a time bitter; it becomes yellow on exposure to the light. It is nearly insoluble in cold water, soluble in 250 parts of boiling water, in 40 parts of cold and 3 parts of boiling alcohol, and in 160 parts of ether, and is readily soluble in chloroform.

PHYSIOLOGICAL EFFECTS.—Krauss* experimentally ascertained that it was absorbed by the blood, where it exists for a time undecomposed; he states, too, that it affects the central nervous system, in small doses as a narcotic; in large, as a tetanizer, the symptoms being (occasionally but not invariably) vomiting, giddiness, ocular scintillations, incoherence of ideas, stupor, coldness of the skin, with clammy perspiration, and, finally, tetanic convulsions. A remarkable effect produced by santonin, even in moderate amounts, is a change in the field of vision, so that objects are seen as if through a *yellow* medium. When allowed to remain in the system, santonin is supposed to be converted into a substance termed xanthopsin, which is eliminated through the kidneys, producing a yellow discoloration of the urine, and probably it is this transformation which gives rise to the poisonous symptoms occasionally noticed.* Hence, santonin is best administered with calomel or other purgatives. W. G. Smith† detected santonin in his own urine, but he could not find it in the saliva.

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* Inaug. Diss. Tübingen, 1869, *Ueb. d. Wirk. d. Santonins, etc.*

TOXICOLOGY.—In large doses it is capable of producing serious and sometimes fatal poisoning,‡ gr. vj. having killed a child aged 5 years thirty-five minutes after ingestion.

MEDICINAL USES.—Santoninum is the anthelmintic constituent of santonica, and is a most efficient remedy for *lumbrici*. It should be followed in a few hours by castor-oil, or other purgative.

ADMINISTRATION.—Dose, gr. ss–v two or three times a day, in the form of syrup, in pill or capsule.

Sodii Santoninas (*Sodium Santoninate*) ($2NaC_{15}H_{19}O_4.7H_2O$) is made by adding santonin as long as it is dissolved, to a hot solution of caustic soda and allowing the liquid to evaporate slowly. It is rapidly absorbed after ingestion, appearing in the urine in half an hour. It produces effects similar to those of santonin, but of a milder grade (Krauss, *loc. cit.*).

Trochisci Sodii Santoninatis (*Troches of Sodium Santoninate*); each troche contains gr. j of sodium santoninate, with sugar, tragacanth, and orange-flower water.

AZEDARACH.

This is the BARK of the ROOT of Melia Azedarach, or Pride of China (*Nat. Ord.* Meliaceæ), an Asiatic tree cultivated extensively as an ornamental tree in our Southern States. It has a bitter, nauseous taste, and yields its virtues to boiling water.

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* Some persons would seem to be peculiarly susceptible to the action of this drug, as Dr. H. Morris has seen all the poisonous effects above described, except the convulsions, produced in a woman 35 years of age, to whom he had administered two doses of gr. ¼ of santonin with gr. j of calomel at an interval of 2 hours.

† *Dublin Quart. Journ. of Med. Sci.*, 1870, p. 296.

‡ *St. Thomas' Hosp. Reports*, Vol. X.

EFFECTS AND USES.—Its effects are said to *resemble* those of spigelia, and it is used against *lumbrici* as a vermifuge.

ADMINISTRATION.—The decoction is the preferred form of exhibition (℥jv in water Oij, boiled to Oj); dose for a child, f℥ss every two or three hours, till it affects the stomach and bowels; or night and morning for several days.

ASPIDIUM.

Aspidium filix-mas, or Male Fern, and A. marginale (*Nat. Ord.* Filices) are plants found in both hemispheres, from Greenland to Natal, and from Japan to Peru, though not indigenous in the eastern United States. They have a perennial horizontal root, from which spring numerous annual oval, lanceolate, acute, bright-green pinnate fronds or leaves, from a foot to four feet in height, grouped together in the form of a base; the leaflets are deeply lobate, oval, crenate at their edges, and gradually diminish from the base of the pinna to the apex.

DESCRIPTION AND CONSTITUENTS.—The RHIZOME is the portion used. It is a long, cylindrical caudex, *covered with portions of the stipes*, and as found in the shops it is generally broken into fragments of a brown color externally, internally yellowish-white or greenish, with a peculiar feeble odor and a sweetish, bitter, astringent, nauseous taste. It deteriorates by keeping. It contains *filicic acid* ($C_{14}H_{18}O_5$), on which its medicinal properties are said to depend; also *volatile oil*, *fixed oil*, *resin*, *tannic* and *gallic acids*, etc.; ether is the best solvent to extract its virtues. Besides the above, Daccomo* has isolated a *waxy-substance* ($C_{13}H_{26}O$), *aspidol* ($C_{20}H_{34}O$), and two *resins*. He failed to find the essential oil obtained by Schoonbroodt.†

TOXICOLOGY.—A fatal case of poisoning ‡ by aspidium has been reported, with symptoms of choleraic diarrhœa. The patient was given ℥j½ of an ethereal extract by mistake. The post-mortem appearances were intense congestion of the stomach, with ecchymoses beneath the mucous membrane and blood-clots on the mucous surface.

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* *Annali di Chimica*, Agosto, 1887, p. 69. An elaborate investigation. See also *Am. Journ. Pharm.*, 1889, p. 144.

† *Jour. de Méd. de Chir. et de Pharm.*, Bruxelles, 1868, p. 64.

‡ *Lancet*, Oct., 1882, p. 630.

Effects and Uses.—Aspidium possesses tonic and astringent properties; but its chief use is to cause the *expulsion of tænia*, which it destroys by a specific action. J. Harley * states that it does not kill the entozoon, but simply detaches it from the intestinal wall, and causes its evacuation by the force of the peristaltic contractions induced by its action. Its efficacy as a vermicide has been long and well attested.

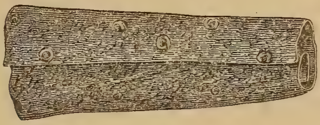
Administration.—Dose, of the powder, ʒj–iij, in electuary or emulsion, night and morning for one or two days. The *oleo-resin* (*oleoresina aspidii*) is the best preparation; it is a dark, thick liquid, of a bitterish, nauseous, slightly acrid taste; dose, fʒss–j night and morning for a day or two, to be followed by a cathartic. As a sediment is deposited from it on standing it should be shaken before use. The administration of the tæniacide agents should always be preceded by a twenty-four hours' fast.

GRANATUM—POMEGRANATE.

The bark of the root of Punica Granatum is used for the expulsion of tænia.

Chemical Constituent.—It contains *pelletierine* ($C_8H_{15}NO$), which, according to the later researches of its discoverer, M. Tanret,† is a compound body, consisting of several alkaloidal principles.

FIG. 63.



PUNICA GRANATUM, ROOT-BARK.

Effects and Uses.—Pelletierine in large doses is said to cause paralysis of the motor-nerves, without affecting sensation, and to dilate the capillaries. Pomegranate is an active *tæniacide*, but is apt to cause nausea and sometimes vomiting. Pelletierine tannate may be given in doses of gr. v–xv on an empty stomach, and is best preceded by a purgative. If the drug do not move the bowels, a brisk cathartic should follow its administration. Bérenger-Féraud ‡ observed that the exhibition of a drastic, as jalap, or scammony, with pelletierine, decidedly aided this agent in the expulsion of tænia.

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* "*Royle's Materia Med.*," p. 370. † *Bull. Gén. de Thérap.*, XCVIII, p. 316.

‡ *Bull. Gén. de Thérap.*, Août. 15ième, p. 120, 1888.

Besides its *tæniacide* action, granatum is a powerful styptic.

ADMINISTRATION.—It is given in decoction (℥ij to water Oij, boiled to Oj); dose, fʒij or more.

Oleum Terebinthinæ (*Oil of Turpentine*) (*see* p. 405) is used as a remedy for *tænia* and other worms. Dose, f℥j, combined with or followed by castor oil.

Calomel (*see* p. 436) is a valuable anthelmintic, given in cathartic doses.

Brayera (*Koosso*). The FEMALE INFLORESCENCE of Brayera anthelmintica (*Nat. Ord.* Rosaceæ), a native of Abyssinia, have been introduced into European practice as an anthelmintic, under the name of *Koosso.*

DESCRIPTION AND CONSTITUENTS.—They occur in broken, compressed clusters of a greenish-yellow color, a fragrant balsamic odor, and a faint taste which after a time becomes acrid and disagreeable. They yield *gum*, *resin*, *fatty matter*, *tannic acid*, and about three per cent. of a peculiar principle termed *kosin* ($C_{31}H_{38}O_{10}$), a yellow-white crystalline resin, without smell or taste, to which its anthelmintic properties are attributed (Bedell*).

EFFECTS AND USES.—In large doses brayera may cause vomiting, colic and diarrhœa. It is used against *tænia*, which it kills, and should be followed by an active purge. Brayera is best given upon an empty stomach, after a previous evacuation of the bowels.

ADMINISTRATION.—*Extractum Brayeræ Fluidum* (*Fluid Extract of Brayera*); dose, fʒij–ijv. The *infusion* (not official) is made with 6 parts of the powder and 100 parts of boiling water. The kosin being insoluble it is to be taken unstrained.

KAMALA.

This is the GLANDS and HAIRS obtained from the capsules of Mallotus philippinensis (*Nat. Ord.* Euphorbiaceæ), a small tree of Hindostan and the East India islands.

DESCRIPTION AND CONSTITUENTS.—It is an orange-red, granular, inflammable powder, with little smell or taste, insoluble in cold, and nearly so in boiling water, forming, with alcohol, ether or chloroform, red solutions, due to the extraction of the resin. It consists chiefly of resinous substances, to one of which, soluble in ether, and considered the active constituent, the name of *rottlerin* ($C_{22}H_{20}O_6$) has been given.

---

* "*Biennial Retrosp. etc., New Syd. Soc.,*" 1867–8, p. 475.

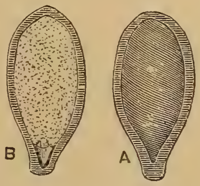
EFFECTS AND USES.—*Kamala* (formerly called *Rottlera*) is a gastro-intestinal irritant. It is a highly-esteemed *tæniacide* in India, and has been introduced as such into Europe and our own country.

ADMINISTRATION.—Dose of the powder, ʒi–ij, suspended in syrup. A tincture (℥vj to alcohol Oj) is given in the dose of fʒj–jv. Castor-oil should be taken after the medicine.

PEPO—PUMPKIN-SEED.

The SEED of Cucurbita Pepo, or common Pumpkin (*Nat. Ord.* Cucurbitaceæ).

FIG. 64.



CUCURBITA PEPO.

A. Divided. B. Entire.

DESCRIPTION AND CONSTITUENTS.—The seeds are oval, flattish, grooved, 9 lines long by 5 or 6 in breadth, of a light brownish-white color, a sweetish, oily taste, and an aromatic smell. They owe their activity to a *principle* soluble in ether, chloroform, and especially alcohol.

EFFECTS AND USES.—This is probably the most efficacious remedy known for the destruction and expulsion of *tape-worm.*

ADMINISTRATION.—Dose, ℥j–ij of the *fresh seeds*, deprived of their outer envelope, beaten to a paste with finely-powdered sugar, and diluted with water or milk, may be taken after a twenty-four hours' fast, and followed in two or three hours by a dose of castor-oil. A fluid extract, made with alcohol and glycerin, is probably the best preparation; dose f℥ss–j.

APPENDIX.

SIGNS AND ABBREVIATIONS USED IN PRESCRIPTIONS.

℞, *Recipe*, take.
āā, *Ana* (*ava*), of each.
℔, *Libra*, *libræ*, a pound, pounds.
℥, *Uncia*, *unciæ*, an ounce, ounces.
ʒ, *Drachma*, *drachmæ*, a drachm, drachms.
℈, *Scrupulus*, *scrupuli*, a scruple, scruples.
O, *Octavius*, *octavii*, a pint, pints.
f℥, *Fluiduncia*, *fluidunciæ*, a fluidounce, fluidounces.
fʒ, *Fluidrachma*, *fluidrachmæ*, a fluidrachm, fluidrachms.
♏, *Minimum*, *minima*, a minim, minims.

Ad 2 Vic., *Ad duas vices*, at two takings.
Ad Lib., *Ad libitum*, at pleasure.
Add., *Adde*, *addantur*, add, let be added.
Altern. Horis, *Alternis horis*, every other hour.
Aq. Destil., *Aqua destillata*, distilled water.
Aq. Ferv., *Aqua fervens*, hot water.
Aq. Fluvial., *Aqua fluvialis*, river-water.
Aq. Font., *Aqua fontana*, spring-water.
Aq. Pluv., *Aqua pluvialis*, rain-water.
Bis Ind., *Bis indies*, twice a day.
Bull., *Bulliat*, *bulliant*, let it or them boil.
Cap., *Capiat capiendum*, let the patient take it; it must be taken.
Chart., *Chartula*, *chartulæ*, a small paper, or papers.
Cochleat., *Cochleatim*, by spoonfuls.
Coch. Mag., *Cochleare magnum*, a tablespoonful.
Coch. Med., *Cochleare medium*, a dessertspoonful.
Coch. Parv., *Cochleare parvum*, a teaspoonful.
Col., *Cola*, *coletur*, strain, let it be strained.
Collyr., *Collyrium*, an eye-water.
Comp., *Compositus*, compounded.
Cong., *Congius*, *Congii*, a gallon, gallons.
C. M. S., *Cras mane sumendus*, to be taken to-morrow morning.
C. N., *Cras nocte*, to-morrow night.
Decoc., *Decoctum*, a decoction.
De D. in D., *De die in diem*, from day to day.
Dieb. Altern., *Diebus alternis*, every other day.

Dil., *Dilue, dilutus*, dilute, diluted.
Dim., *Dimidius*, one-half.
Div., *Divide*, divide.
D., *Dosis*, a dose.
Elec., *Electuarium*, an electuary.
Enem., *Enema, enemata*, a clyster, clysters.
Exhib., *Exhibeatur*, let it be administered.
F. H., *Fiat haustus*, let a draught be made.
Fil., *Filtra*, filter.
Ft., *Fiat, fiant*, let there be made.
Garg., *Gargarysma*, a gargle.
Gr., *Granum, grana*, a grain, grains.
Gtt., *Gutta, guttæ*, a drop, drops.
Guttat., *Guttatim*, by drops.
Haust., *Haustus*, a draught.
Ind., *Indies*, daily.
Inf., *Infunde*, pour in.
Infus., *Infusum*, an infusion.
Inj., *Injiciatur*, let it be injected.
Jul., *Julepus, julepum*, a julep.
M., *Misce*, mix.
Mane, in the morning.
Mist., *Mistura*, a mixture.
Mic. Pan., *Mica panis*, crumb of bread.
No., *Numero*, in number.
Omn. Hor., *Omni horâ*, every hour.
Omn. Bid., *Omni biduo*, every two days.
Omn. Bih., *Omni bihorâ*, every two hours.
Omn. Man., *Omni mane*, every morning.
Omn. Nocte, *Omni nocte*, every night.
Omn. Quadr. Hor., *Omni quadrante horæ*, every quarter of an hour
Ph., Pharmacopœia.
Pocul., *Poculum*, a cup.
P. R. N., *Pro re natâ*, as the symptoms may call for.
Pulv., *Pulvis*, a powder.
Q. P., *Quantum placeat*, as much as you please.
Q. S., *Quantum sufficit*, enough.
Quor., *Quorum*, of which.
Redig. in Pulv., *Redigatur in pulverem*, let it be reduced to powder.
Repet., *Repetatur, repetantur*, let it or them be repeated.
S., *Signa*, write.
S. A., *Secundum artem*, according to art.
Semih., *Semihorâ*, half an hour.
Sign., *Signatura*, a label.
Ss., *Semis*, a half.
Sum., *Sume, sumendus*, let it be taken.
Tabel., *Tabella*, a lozenge.
Troch., *Trochiscus*, a lozenge.
Trit., *Tritura*, triturate.

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  Baths (in 2nd stage), at 100° F., 1–3 times daily, for 20 minutes, followed by drying and envelopement in hot flannels and taking warm aromatic drinks. Very good results claimed for this plan.
  Camphor 125, Opium 86, and Lead acetate 199 of each gr. j, every ½–2 hours to check initial diarrhœa
  Cantani's plan or enteroclysis; viz., intestinal irrigation above the ileocœcal valve with tannin, ʒ ⅛–¼; acacia, ℥j; laudanum, gtt. xx; water (sterilized by boiling) at 102° F., Oiij–iv. The injections should be given early, and about 2 to 6 daily. In the algid stage the hypodermic injection of about Oj of a solution of sodium chloride (4 per cent.) and carbonate (3 per cent.) into the abdomen below the costal arches to supply salines and water lost in the discharges.
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- Naphthaline, to prevent urinary decomposition, 518.
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- Chalk mixture, 484.
- Charcoal, 538.
- Chlorodyne, 118.
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- Gallic acid, 188.
- Hope's camphor mixture, very useful, 126.
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- Lime preparations, 482.
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- Opium or Morphia, 86.
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- Arsenic, 461.
- Baths, natural hot, 41.
- Carbolic acid, 501, in ointment or glycerin preceded by shampooing with soap and water.
- Corrosive sublimate ointment, 440.
- Donovan's solution, 564.
- Fowler's solution, 462.
- Leuk water baths, 484.
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- Concentrated salines to remove dropsy, 343.
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- Iodine tincture to chest, 447.
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- Antipyrine, 527.
- Alcohol, to sustain heart, 217.
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- Cimicifuga, 287.
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Liquor calcis, topically, 483.
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Ferric chloride tincture of, 170.
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Alkaline diuretics well diluted, as Potassium acetate, 386.
Benzoic acid, 508.
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- Bismuth subnitrate, 209.
- Carbolic acid, 500, and Creasote, to prevent decomposition of food, 503.
- Lime water, 483.
- Manganese oxide, 176.
- Silver nitrate, 209.
- Skim milk diet.

RACHITIS.
- Calcii phosphas precipitatus, 465.
- Creta preparata, 484.
- Morrhuol, 454.
- Phosphoric acid dilute, 181.
- Phosphorus, 185.
- Sodium phosphate, 345.

RECTOCELE.
- Alum, 212. } Topically.
- White oak bark, 193. } Topically.

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RHEUMATISM, ACUTE.
- Acetanilide, 500.
- Ammonium bromide, 300.
- Antipyrine, 527.
- Chinoline, 522.
- Cold bath or pack, 42.
- Colchicum and Colchicine, 392–3.
- Cotton to joints, 276.
- Dover's powder, 89.
- Fuller's alkaline treatment, 475.
- Gaultheria, 231.
- Opium or Morphine, 86.
- Potassium acetate, 386.
- Potassium bicarbonate, 475.
- Quinine, 156.
- Salicin, 161.
- Salicylic acid, 514, or Sodium salicylate, 515.
- Saline cathartics, 342.
- Salol, 516.

RHEUMATIC ARTHRITIS.
- Ammonium muriate, with Huxam's tincture, 468.
- Arsenic, 461.
- Baths, natural hot, 41.
- Baths, warm, 40.
- Burgundy pitch plaster, 543.
- Cod-liver oil, 454.
- Croton oil to joints, 551.
- Ferric chloride, tincture of, 170.
- Guaiac, internally, 362.
- Iodine to joints, 447.
- Sodium carbonate, 477.

RHEUMATISM, CHRONIC.
- Aconite, topically, 240.
- Acupuncture, 36.
- Ammonium muriate, 468.
- Arsenic, 461.
- Ballston Spa water, 481.
- Baths, hot and warm, 40.
- Baths, natural hot, and hot air, 41.
- Bedford Springs and Poland water, 479.

RHEUMATISM, CHRONIC (continued).
- Blisters, 545–8.
- Burgundy pitch plaster, 543.
- Caledonian Spring waters, 349.
- Camphor, topically, 125.
- Carlsbad water, 351.
- Cold douche, 42.
- Cotton, 276.
- Cod-liver oil, 454.
- Electricity, 46.
- Frictions, 36.
- Iodine, topically to joints, 447.
- Lithium preparations, 481.
- Massage, 52.
- Menthol, topically, 232.
- Mezereum, 383.
- Phytolacca, 248.
- Potassium iodide, 450.
- Saratoga water, 482; Wiesbaden, 351.
- Sarsaparilla, 381.
- Soap liniment, 126.
- Sodium phosphate, 346; Salicylates, 515.
- St. Catherine's wells, 348; St. Louis' springs, 478.
- Stillingia, 385.
- Sulphur natural waters, 338–9–40.
- Veratrine ointment, 246.

RHEUMATISM, GONORRHŒAL.
- Anodyne poultices to joints, 560.
- Belladonna liniment, 100.
- Blisters, small, to parts early, 545–8.
- Potassium iodide, 450.
- Saline purgatives, 342–7.
- Salicylic acid, 514; Sodium salicylate, 515.
- Treat the gonorrhœa, 409.

RHEUMATISM, MUSCULAR (see Myalgia and Chronic rheumatism).

RINGWORM (see Tinea).

ROSEOLA.
- Ordinarily no special treatment required. Petrolatum, 579, or Zinc oxide ointment benzoinated, 205, to allay cutaneous irritation.

RUBEOLA (see Measles).

RUPIA.
- Antiseptic ointments of Peppermint Oil and Vaseline, on lint, 232, or Bismuth, Iodoform and Boracic acid, 210.
- Antisyphilitic treatment with Mercury, 428, or Potassium iodide, 450.
- Citrine ointment, 443.
- Mercurial ointment, 432.

SALIVATION (see Mercurialismus).

SARCINA VENTRICULI.
- Carbolic acid, 500.
- Resorcin, 511.
- Salicylic acid, 514.
- Sulphurous acid, 491.

SCABIES.
Carbolic acid, 500.
Liquor calcis, 483.
Napthol, 520.
Phytolacca, 248.
Staphisagria, 249.
Sulphides in form of ointment, 338.
Sulphur ointment, 337.
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Carbolic acid, 501.
Glycerin treatment, 378.
Goulard's cerate, 200.
Liniment calcis (carron oil), 583.
Sodium bicarbonate, sprinkled over, 478.
SCARLET FEVER.
Aconite, to moderate pulse, 239.
Acetanilide, 506.
Adeps as fatty inunction, 574.
Bath, cold, to moderate fever, 42.
Carbolic acid internally (of doubtful utility), 500.
Digitalis, 281.
Glyceritum amyli to allay heat of skin, 573.
Petrolatum, 578; or Olive-oil, 333, as inunction.
Potassium chlorate gargle for throat, 470.
Quinine as antipyretic, 156.
Sodium benzoate, 509.
SCIATICA.
Aconitine topically, 241.
Antipyrine, 527.
Atropine hypodermically, 98.
Blisters, Collodion cum cantharide, 549; or a milder application, Charta sinapis, 541; both over nerve.
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No. 1.

JULY, 1892.

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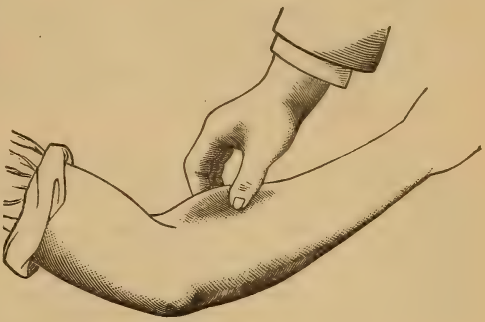

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